AVIATION WEEK

A McGRAW-HILL PUBLICATION

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Grumman

Designers and builders of AIRCRAFT

Navy's PANTHERS Have Folding Wings

GRUMMAN PANTHERS are designed to operate efficiently from carrier bases. For instance, the wings of these traditionally rugged GRUMMAN fighters fold up to conserve space on shipboard.

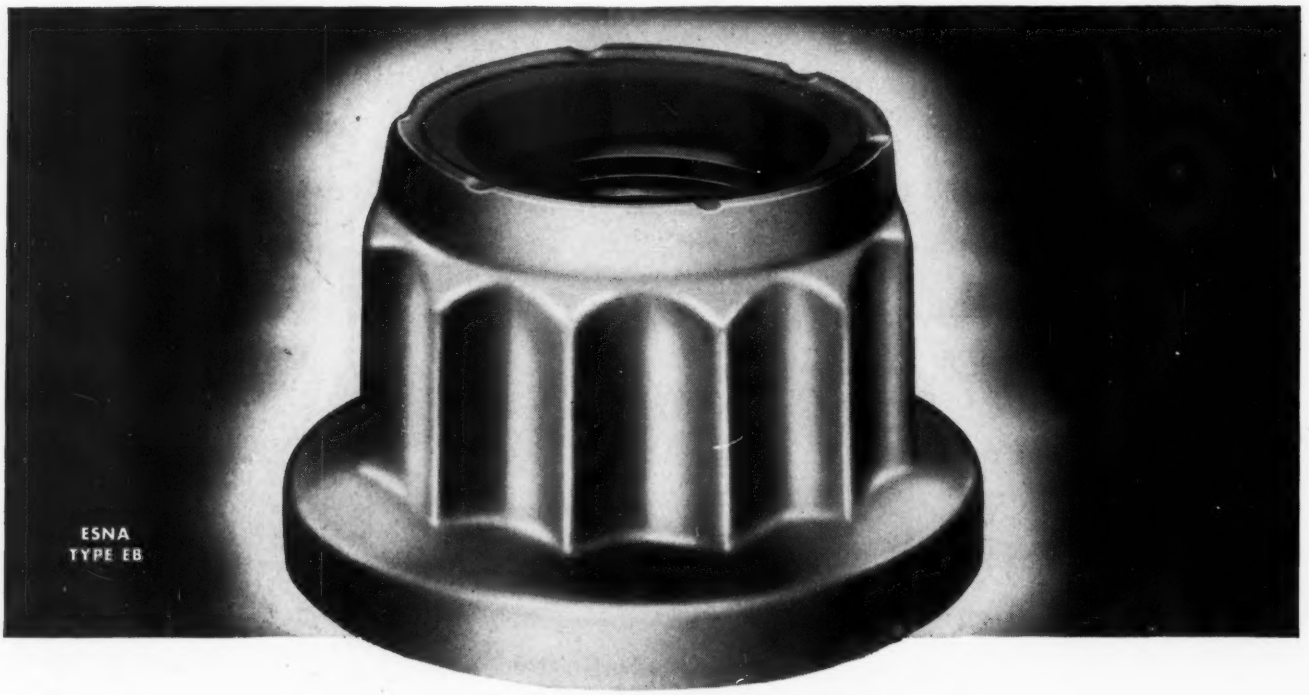
In addition to these new Navy jet fighters GRUMMAN is building aircraft for the U. S. Air Force and for commercial users . . . aircraft designed to give maximum performance in their specific tasks.

★ ★ ★

GRUMMAN AIRCRAFT ENGINEERING CORPORATION, BETHPAGE, LONG ISLAND, NEW YORK

Contractors To The Armed Forces

High Strength DOUBLE HEX NUT CUTS SIZE...WEIGHT OF AIRFRAME COMPONENTS



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The NEW ESNA HIGH Strength-Double Hex Nuts have been scientifically engineered to accomplish distribution of thread load with minimum weight and wrench diameter. They develop 185,000 psi. min. in NAS high strength aircraft bolts, and are completely interchangeable with existing internal wrenching nuts; yet this unique double hex design saves 66% in weight and 50% in height, compared to the old internal wrenching types. These savings in weight and clearance gain greater importance when multiplied by the additional savings in the size and weight of component parts or fittings which the new design makes possible to employ.

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ANCHOR

HIGH TEMPERATURE

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► Twenty years ago, Transcontinental Air Transport, Inc. — now Trans-World Airlines—inaugurated its transcontinental service with a fleet of Ford tri-motor airplanes. From that modest beginning, TWA has grown into the largest user of Constellations on both domestic and foreign routes . . . into one of the great leaders of modern air travel development.

► And now to TWA, Wright Aeronautical says . . . more power to you as you continue to expand and improve your great cross-country and trans-oceanic air service.

THE POWER BEHIND MANY TWA "FIRSTS"

► During 20 years' operation, Trans-World Airlines . . . and its predecessor, Transcontinental Air Transport, Inc., pioneered many major advancements.

► It was the first airline to use Constellations. It initiated all-air cross-country passenger service and the employment of combination lounge-sleeper planes and 4-engine equipment on passenger schedules.

► TWA also pioneered high altitude commercial flying with pressurized cabins . . . the use of all-cargo aircraft, flight plans based on flight-route weather analysis and many other new airline developments.

► Wright Aeronautical . . . provider of power for many of these pioneering achievements . . . is now developing through research and engineering more and better power to meet TWA's increasing requirements in the years to come.

POWER FOR AIR PROGRESS

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Aviation Week

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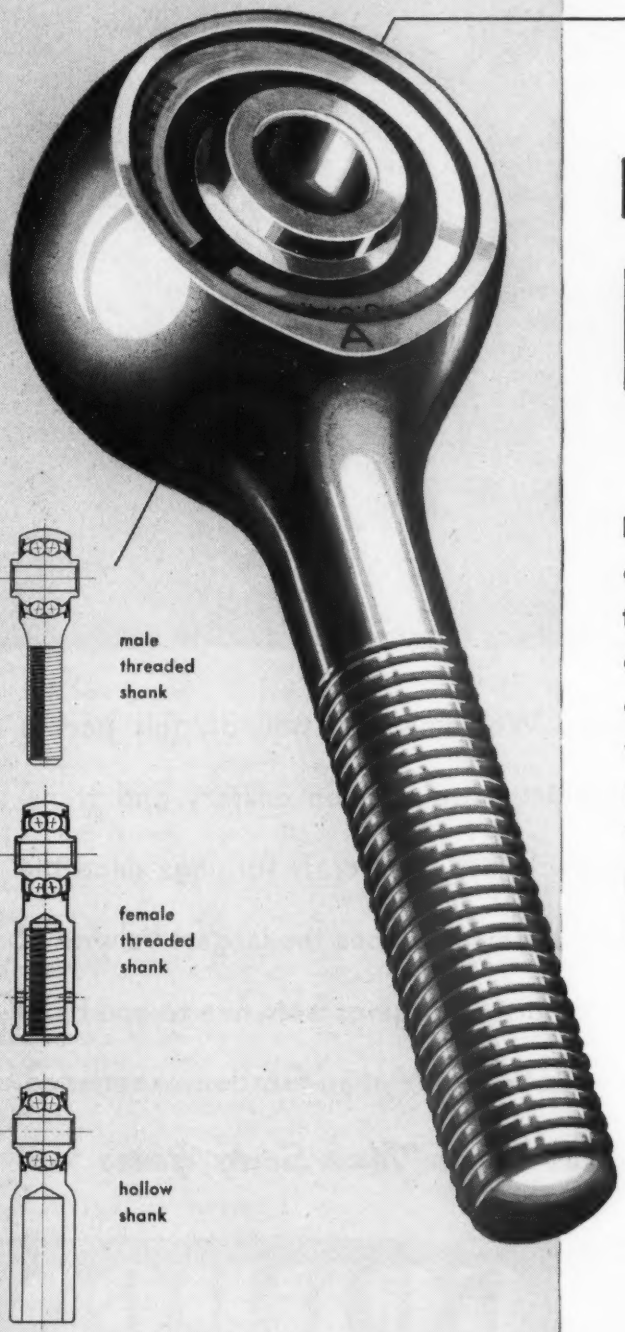

male threaded shank

female threaded shank

hollow shank

Fafnir Rod Ends permit a 10° misalignment in either direction. Exposed surfaces as mounted are cadmium plated. Light, compact design . . . outer race ground directly in shank member. Special heat treatment — an exclusive Fafnir feature — insures shank toughness — eliminates brittleness and cracking. Inner race extension beyond face obviates need of spacers. Prelubricated to specifications AN-G-25.

Fafnir Ball Bearing ROD ENDS

Rod ends are just an instance of the readiness of the Fafnir Aircraft Division to deliver all types and sizes of ball bearings. Fafnir designing never stopped, Fafnir engineering continued without let-up. Today Fafnir is ready with ample stocks of aircraft ball bearings in designs to meet the latest requirements. Write today for the new "red" catalog of Fafnir Aircraft Ball Bearings. The Fafnir Bearing Company, New Britain, Conn.

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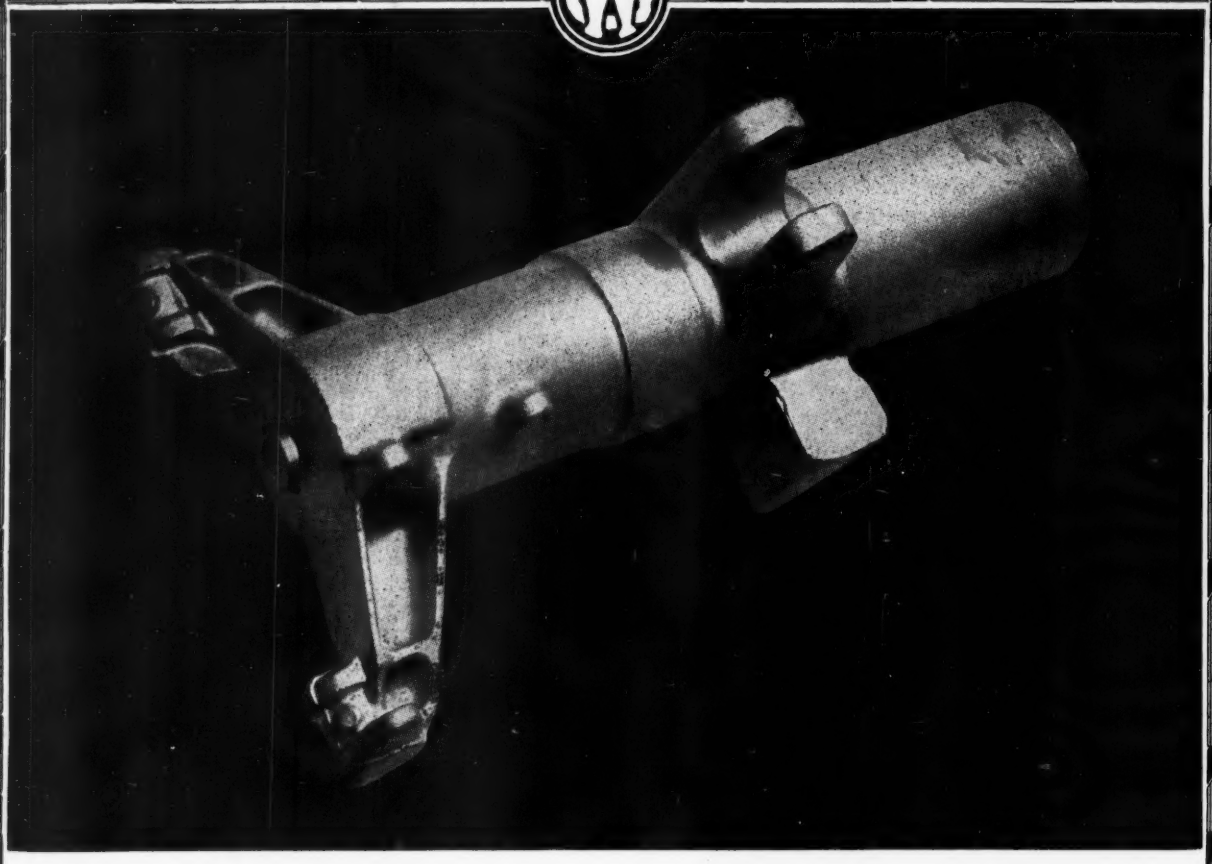

Aircraft Landing Gear Forging—Weighing 275 pounds, this part is typical of the many large intricate forgings required on military and transport aircraft. Wyman-Gordon has specialized in aircraft forgings since the beginning of the aviation industry, and today produces the largest volume of the greatest variety of these important parts—forgings from five to one thousand pounds. And—there is no substitute for Wyman-Gordon experience.

Standard of the Industry for More Than Sixty Years

WYMAN-GORDON

Forgings of Aluminum, Magnesium, Steel

WORCESTER, MASSACHUSETTS, U. S. A.

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WHO'S WHERE

Changes

Consolidated Vultee Aircraft Corp. elected **Ray O. Ryan** and **R. C. Sebold** vice presidents. Ryan, who has been in charge of B-36 production for the past year, continues to serve as manager of the Fort Worth division. Sebold, a Convair veteran, was at first project engineer and later in charge of engineering of the B-36. Now he will be v.p.-engineering.

Ralph W. Starkey has been appointed executive vice president and general manager of U. S. Airlines, one of the recently-certificated all-cargo carriers. He formerly was director of cargo of Eastern Air Lines.

Oswald A. Byrne has been appointed assistant to the president of Challenger Airlines. He will also be assistant general traffic and sales manager. He has been with Challenger since the founding of the company in 1947.

Rex Brack has been appointed general traffic manager for Braniff Airways. He has been general traffic and sales manager for the carrier's domestic division.

H. G. Erickson is new chief engineer of Texas Engineering & Mfg. Co. He held same post at now-bankrupt Luscombe Airplane Corp. . . . **Salviano R. Herrera** is director of North American operations for FAMA, Argentine airline. Headquarters are at Fifth Avenue and 58th Street, New York City. . . . **Robert Lockhart, Jr.,** has been promoted to communications superintendent of Pan American Airways' Latin American division. . . . **William B. Caldwell, Jr.,** has been named manager of tariffs and schedules for National Airlines. . . . **John M. Sitton,** formerly Bendix Radio's public relations man, at present is district manager in Baltimore for Modern Railroads magazine.

Departures

Leslie J. Trigg has resigned as chief engineer of Sensenich Corp., Lancaster, Pa., propeller manufacturer. He is taking a vacation before announcing future plans, and can be reached at 232 Farmington Avenue, Hartford 6, Conn. He is credited with the design of most of the postwar Sensenich propellers.

Richard A. Dick has resigned as vice president-sales, Western Air Lines, after 17 years in air transportation. He joined WAL in 1940. He will concentrate on developing Sales Unlimited, a company specializing in western sales coverage for selected distributors and manufacturers.

C. W. Smith, assistant to vice president Stanley Osborne, Eastern Air Lines, has resigned to open a consulting business to airlines on problems associated with schedule and tariff revisions.

Dr. Louis B. Tucker has retired from the National Bureau of Standards after 30 years' service. The inventor of the Tuckerman optical strain gage, he is widely known for his investigations of aircraft materials and structures.

INDUSTRY OBSERVER

► A. V. Roe Canada Ltd. has an order for ten twin-jet night fighters (C-100) from the Canadian government. The two-man night fighter (AVIATION WEEK, Nov. 8) will probably get its power from two Orenda axial flow turbojets developed by A. V. Roe in Canada. Initial development cost of the XC-100 was $3,950,000 according to Canadian Defense Minister Brooke Claxton. Production is scheduled to begin as soon as XC-100 prototype tests are completed.

► **Canadian government is planning to add $8 million to its fiscal 1950 RCAF budget for additional F-86 production by Canadair Ltd. of Montreal and more development work on the Avro Orenda turbojet engine.**

► Lockheed Constellations operated by the Atlantic division of Military Air Transport Service have had their landing gears beefed up to take a gross weight increase from 102,000 lb. to 107,000 lb. The additional fuel carried will enable them to make the North Atlantic hop nonstop from Stephenville to Frankfurt in about 12 hours. Lieut. Col. Stanley Hand, Commander of the Constellation squadron, recently piloted the first beefed-up Connie in a 12 hr. 40 min. nonstop flight from Westover Field, Mass., to Frankfurt.

► **British engine manufacturers have definitely begun the switch from centrifugal flow to axial flow for their most powerful turbojets. In addition to the 7500-lb. thrust axial flow Avon built by Rolls-Royce, which has been flying experimentally for about 18 months, Armstrong Siddeley Motors Ltd. is working on the Sapphire, an axial flow project taken over from Metrovick and assumed to be a more powerful development of the earlier axial flow 4200-lb. thrust Beryl used in the Saunders Roe jet flying-boat fighter.**

► Second of the three Saunders Roe Ltd. SR-1 jet flying-boat fighters crashed during a Battle of Britain celebration at Felixstowe. The fighter dived into the sea while doing aerobatics. First one sank about 6 weeks ago, while taxiing off Cowes. Some British aviation writers have been bemoaning the fact that development on this type has lagged because it falls into a jurisdictional vacuum between the RAF and the Royal Navy. RAF is not supposed to be interested in naval fighter planes and the Navy is barred from developing flying-boats.

► **James Martin, chief executive and designer of Martin-Baker Aircraft Co. Ltd., is among the British designers working on supersonic delta wing fighter designs. One Martin delta wing design project buries the cockpit almost completely in the triangular wing with a vertical fin running almost two-thirds of the cockpit length.**

► If your are wondering what happened to one of your favorite Air Force test pilots, the answer lies in a USAF directive that specifically prohibits an Air Force pilot from participation in more than one flight of an unusual or spectacular nature. Such pilots as Capt. Charles E. Yeager (first supersonic flight); Maj. Richard L. Johnson (present subsonic speed record holder); Maj. Gus E. Lunquist (first Jet Thompson winner), have all long since returned to routine flight test work, while other pilots are handed new spectacular assignments.

► **Grumman F9F Panther Navy jet fighter has completed carrier qualification trials aboard the U. S. S. Franklin D. Roosevelt and is now going into squadron service. It is capable of Mach number 0.95 and has reached 53,000 ft. in routine test flights.**

► Martin-Baker has a new version of its ejection seat ready for experimental flight testing. The new seat operates automatically after the pilot pulls down the canvas protective screen over his face. This motion also fires the seat. A six-second time switch automatically releases the pilot from the ejected seat after a small drogue chute has slowed and stabilized it. The new seat uses a double charge of nitrocellulose to ease the shock of ejection on the pilot. Seat travels 10 inches from impact of first charge before the second charge is fired. The automatic time switch has a safety gadget that will not release the pilot from the ejected seat over 10,000 ft.

MERCY SPECIAL
The new, and equally versatile AVITRUC
C-123—virtually a flying hospital--CHASE'S
answer to the need for fast, dependable res-
cue operations. Offers complete hospitaliza-
tion for up to 50 cases immediately upon res-
cue--but one phase of AVITRUC versatility.
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AVIATION CALENDAR

Oct. 12-15—Air Reserve Assn. convention, Long Beach, Calif.

Oct. 12-15—University of Oklahoma-sponsored meeting on problems in airport management and operations, co-sponsored by Southern Flight magazine. Meeting will be held at Oklahoma University's Max Westheimer Field.

Oct. 13-15—1949 conference on airport management and operations, sponsored by University of Oklahoma and Southern Flight magazine, Norman, Okla.

Oct. 13-15—Eighth Annual Convention, Air Line Dispatchers Assn., Congress Hotel, Chicago.

Oct. 17—Fall meeting, New York State Aviation Council, Hotel Syracuse, Syracuse, N. Y.

Oct. 17—36th NASC steering committee meeting, Dayton, O.

Oct. 17-18—Airport management conference, sponsored by the New York State Department of Commerce, Hotel Syracuse, Syracuse, N. Y.

Oct. 17-18—Fall meeting, American Society for Testing Materials' Committee D-4 on adhesives, ASTM headquarters, 1916 Race Street, Philadelphia, Pa. Non-members invited.

Oct. 17-21—Fall general meeting, American Institute of Electrical Engineers, Netherland Plaza Hotel, Cincinnati.

Oct. 18-19—6th NAS council meeting, Wright-Patterson AFB, Dayton, O.

Oct. 23-25—CAA Regional Administrators Conference, Oklahoma City.

Oct. 26-27—CAA Nonscheduled Flying Advisory Committee meeting, Oklahoma City.

Oct. 30—Third annual San Francisco Air Fair, sponsored by Junior Chamber of Commerce, San Francisco Airport.

Oct. 30-Nov. 2—Annual convention, National Assn. of State Aviation Officials, New Orleans.

Nov. 9-11—Seventh annual meeting Aviation Distributors and Manufacturers Assn., French Lick Springs Hotel, French Lick, Ind.

Nov. 30-Dec. 2—Annual meeting, Society for Experimental Stress Analysis, Hotel New Yorker, New York.

Jan. 13-15, 1950—All-American Air Maneuvers, Miami.

Feb. 18-26—National Sportsmen's Show, Grand Central Palace, New York, N. Y.

Mar. 6-9—47th annual meeting, American Road Builders' Assn., Netherlands Plaza Hotel, Cincinnati.

Mar. 28-31—National Plastics Exposition, sponsored by Society of the Plastics Industry, Navy Pier, Chicago.

April 16-20—Annual business meeting, American Assn. of Airport Executives, Neil House Hotel, Columbus, Ohio.

PICTURE CREDITS

46—McGraw-Hill World News.

"Big Brother" SETS RECORDS

with the help of

NICKEL ALLOY STEELS

THE BOEING STRATOCRUISER makes wide use of alloy steels containing nickel. Able to carry up to 114 passengers, this 71-ton double-decked airliner spans 141'-3" and extends 110'-4" in length. Cruising speed at 25,000 ft. is 300 to 340 mph. Maximum range is 4,200 miles.

THIS BOEING STRATOCRUISER . . . "big brother" of the B-29 and new B-50 . . . incorporates more than *2305 MAN YEARS* of engineering, development and testing.

The moment this plane left the ground on its first public flight it set a record by taking off with the largest group of people ever to leave King County Airport in Seattle on a commercial airliner.

Able to speed huge loads high above rough air . . . Stratocruiser performance invites attention to the dependability of nickel alloy steels used in its construction.

Weighing less than a pound per horsepower . . . Pratt & Whitney "Wasp Major" engines that power Stratocruisers, demonstrate the considerable weight reduction, safely attained with crankshafts, propeller shafts, master and link rods, gears and highly stressed shafting, bolts and studs made from one or another of the 4300, 8700 or 9300 series of nickel-chromium-molybdenum "triple alloy" steels. In the landing gear, type 8740 nickel-chromium-molybdenum steel plays a vital role.

Boeing engineers specify fire walls, exhaust stacks, hydraulic systems, and various other parts in austenitic chromium-nickel stainless steels.

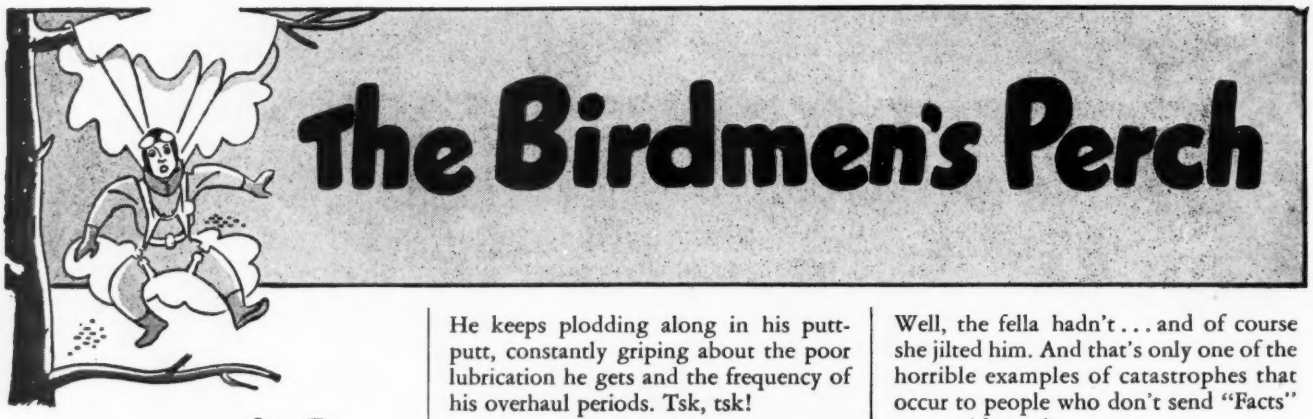
Where you need a high ratio of strength-to-weight, along with extra qualities, such as toughness, or hardness, or resistance to heat, corrosion and erosion . . . we suggest using alloys containing nickel.

Clean, and easy to keep clean, chromium-nickel stainless steel advances hygienic cleanliness in the Stratocruiser. Its galley can serve 75 persons 3 meals without being restocked.

Don't Forget...

Jot down—"INCO Booth, No. 302"—in your memo book of companies to visit at the **NATIONAL METAL EXPOSITION,** at the Public Auditorium in Cleveland, Ohio, Oct. 17th to 21st. Convenient facilities for discussing your problems with our metallurgists and foundry specialists will be available.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N.Y.



There's no end to Gulf Service, b'gosh!

Got a letter from J. A. Sambuco, Bronx, N. Y. as follows:

"I was wheeling down the runway when I saw one of Gulf's putt-putts parked on the apron. The Orange Disc reminded me that I'd forgotten to check my gas shut-off valve before I cracked the throttle. I chopped throttle, braked, and stopped at the end of the runway, and as I taxied off the runway, the engine quit.

"Sure enough, the valve was closed. I now tip my hat to every Orange Disc I pass!"

Thank you, J. A.

Can we move that Gulf Plane now?

SAD STORY FILE

Seems there's a fella who *doesn't* know about that good Gulfpride Aviation Oil —Series D—the world's finest detergent dispersant oil for horizontally opposed engines!

He keeps plodding along in his putt-putt, constantly griping about the poor lubrication he gets and the frequency of his overhaul periods. Tsk, tsk!

Someone should tell him (will it be you?) that Gulfpride is the only aviation oil that's Alchlor-processed. This is the important extra step—after refining the fine crudes—that eliminates carbon-and-sludge formers from Gulfpride Oil.

This means super lubrication! This means overhaul periods can be extended up to 1000 hours, too! Because Gulfpride—series D—frees stuck valves and rings and *keeps* them free longer.

All of which adds up to extra colossal pleasure and enjoyment when you use Gulfpride Aviation Oil—Series D.

Somebody inform our friend!

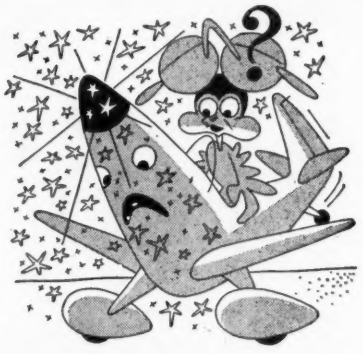
LITTLE KNOWN FACTS DEPT.

So this girl was just about to say "Yes" to the fella.

"Have you ever sent a Little Known Fact About Well Known Planes in to the Birdmen's Perch?" she asked. "Did you send proof in with the Fact? Did you win one of those gorgeous, engraved-type Commissions as a Perch Pilot (bottom rung)?"

Well, the fella hadn't . . . and of course she jilted him. And that's only one of the horrible examples of catastrophes that occur to people who don't send "Facts" to us *with proof!*

Avoid this grievous fate, win a commission, and cover yourself with glory



the way J. Ross Hunter of Sikeston, Missouri, did with:

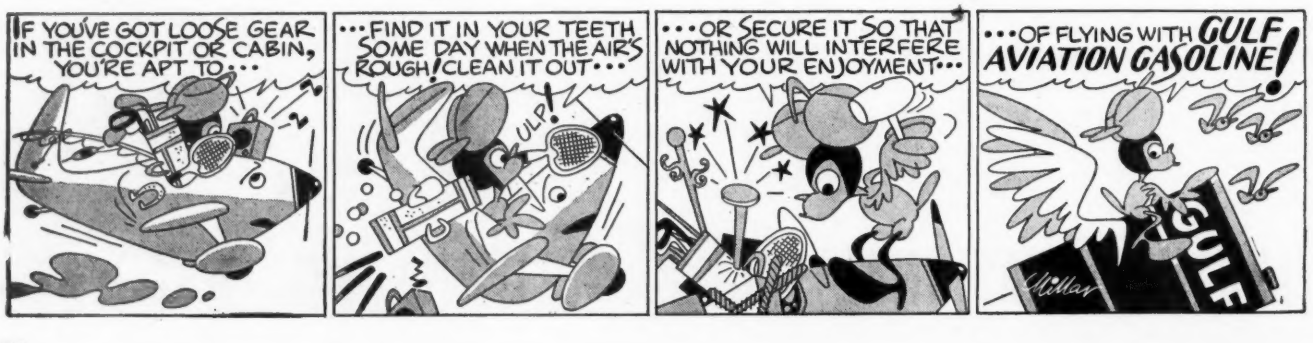
"The breaker-timed system in an 18-cylinder engine is expected to deliver 2,250,000,000 sparks before lubrication or replacement is normally expected!"

See how easy it is?

Don't remain unsung forever! Send your Little Known Fact About Well Known Planes—with PROOF—to this address:
GULF AVIATION DEPT., GULF BUILDING PITTSBURGH 30, PA.

Gulf Oil Corporation and Gulf Refining Company . . . makers of

GULF AVIATION PRODUCTS


IF YOU'VE GOT LOOSE GEAR IN THE COCKPIT OR CABIN, YOU'RE APT TO···
···FIND IT IN YOUR TEETH SOME DAY WHEN THE AIR'S ROUGH! CLEAN IT OUT···
ULP!
···OR SECURE IT SO THAT NOTHING WILL INTERFERE WITH YOUR ENJOYMENT···
···OF FLYING WITH GULF AVIATION GASOLINE!
GULF

NEWS DIGEST

DOMESTIC

Chance Vought's Stratford, Conn., plant, consisting of 43 buildings spread over 53 acres, will be sold jointly by United Aircraft Corp. and the government's General Services Administration. Bids for the single unit will be received at the Office of Surplus Property, 18th and F. Streets, N. W., Washington, D. C., until Nov. 21.

Twin-engine lightplane to sell for less than $20,000 is being developed by Piper Aircraft Corp. and is expected to be ready for test flight during the winter. Plane would gross about 4500 lb. and carry 6-7 persons. Designated the PA-21, it is a high-wing design with retractable gear and tractor propellers.

Tremendous purchasing power *of the USAF was described to businessmen recently by Air Secretary W. Stuart Symington.*

Speaking before the National Security Industrial Assn. in New York City, he said:

"How many people in this room tonight realize that the U. S. Air Force places into private industry far more business in dollars and cents than any other organization in the world?"

Hundreds of businessmen, Symington declared, supply the 600,000 different items purchased by the Air Force. ". . . Less than 40 percent of the budgeted cost of our planes goes to the aircraft company. Thousands of other companies in American industry receive the major portion of the remaining 60 percent."

Air Force indication that it would not renew leases on Trans World Airline's Kansas City headquarters and maintenance base has so alarmed city officials that they are negotiating to buy the property from the government in order to lease the land directly to TWA. The airline has a 4000-person payroll in the area. Board of directors authorized TWA to lease the property from the city, provided: the city can purchase the property; current rents stay; and leases are for five years with two five-year options.

Aircraft shipments by airframe weight totaled 3,165,700 lb. in July, a 6 percent increase over the 2,998,600 lb. reported in June, states the Bureau of Census. Military planes accounted for 83 percent of total airframe weight. July shipments of civil aircraft were 301 planes, a 32 percent decrease in number from the 439 planes shipped during June. Total horsepower of aircraft engines shipped in July totaled 4,404,800, an increase of 24 percent over June's 3,542,800 hp.

National Airlines stockholders approved a 600,000-share increase in capital stock at a recent annual meeting. Increase covers options by Pan American Airways and W. R. Grace & Co. to buy NAL securities as part of interchange agreements entered into by the carriers and subject to Civil Aeronautics Board approval.

Kellett Aircraft Corp.'s H-10 copter crashed. Test pilot David Driskill was killed in attempting to parachute from the craft. Rotor blades severed his shroud lines. Mechanic Charles Daugherty parachuted to the ground safely. H-10 had been accepted by USAF as a rescue transport, but was returned to Kellett for further proving. Crash occurred during test landings.

Western Air Lines received CAA approval to operate hydraulic-driven compressors for the pressurization system on the Convair-Liner for 1000 hr. Approval will probably be given Continental Air Lines shortly.

INTERNATIONAL

Avro 707, delta wing research plane crashed during a test flight near Manchester, England, last week, killing Avro test pilot Sam Esler. The 707 had about three hours total flight time and was being used for research on a four-jet delta wing bomber project at Avro (AVIATION WEEK, Sept. 19).

Trans-Canada Air Lines will not raise domestic rates and fares despite Canadian dollar devaluation. TCA will make little or no change in fares between Canada and U. S., but will increase international rates to sterling areas by about 10 percent, and raise fares quoted in sterling from sterling area countries to Canada by about 25 percent.

Great Britain is planning to use turboprop engines on its Fairey 17 and Blackburn Y. A. 5 naval aircraft, both of which are reported to have made first flights recently. The planes are part of a design competition for an antisubmarine search and bombing aircraft. Fairey 17 already is powered by an Armstrong Siddeley Double Mamba; the Y. A. 5, currently fitted with a Rolls-Royce Griffon piston engine, will probably get the Double Mamba installation in the near future.

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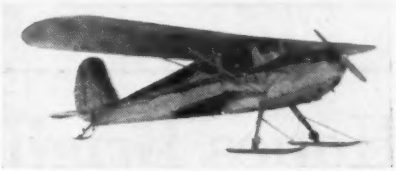

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  Note: An axle adapter arrangement and universal rigging permits interchangeability of various aeroplanes within the gross capacity of each ski model.

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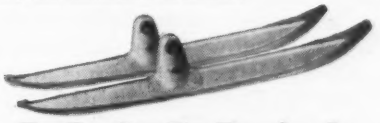

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AVIATION WEEK

Oct. 10, 1949

Hopes Brighten for Bigger USAF Budget

Announcement of atomic blast in Russia may spur restoration of $800 million cut.

Prospects for restoring an $800 million slash in U. S. Air Force funds for fiscal 1950 improved last week as a joint House-Senate conference threshed out the final budget in an atmosphere conditioned by Presdent Truman's announcement of an atomic explosion in Russia.

Prompt reaction in Congress was the voicing of multiple new demands to build up the Air Force as the long-range striking arm needed to deliver the key weapon of any future war—the atomic bomb.

▶ **Restore Slash**—Immediate target of the demands was restoration of the $799,822,000 Senate slash in 1950 fiscal year funds for USAF. This was being handled by the joint House-Senate committee with a decision expected this week. The House approved a $6,215,709,000 budget ($4,222,954,000 cash and $1,992,755,000 contract authorization). The Senate approved only $5,415,887,000 ($4,000,887,000 cash and $1,415,000,000 contract authorization). This was the amount recommended by the Administration. The two key cuts by the Senate were a $577,755,000 reduction in contract authorization for procurement and an $18,000,000 reduction in research and development funds.

Following the Presidential announcement, typical comments by House members on the joint conference committee on the 1950 fiscal year armed services appropriation bill were:

• **Rep. Clarence Cannon (D., Mo.),** chairman of the House Appropriations Committee: "We did not intend to yield to the Senate on the Air Force slash, now we absolutely will not."

• **Rep. George Mahon (D., Tex.),** chairman of the House Appropriations Subcommittee on the Armed Services: "The announcement vindicates our position. It strengthens our hand and gives high hope that the minimum 58-group Air Force contemplated by funds allowed by the House will prevail over the 48-group program allowed by the Senate."

▶ **Senate Weakens**—A weakening among ranks of senators who voted the USAF slash 49 to 9 developed, simultaneously.

Four of nine Senate conferees on the measure predicted "at least a partial victory" for the House, and indicated that they would support an increase in USAF funds over and above the amount approved by the Senate. They were Sen. Richard Russell (D., Ga.), Sen. Joseph O'Mahoney (D., Wyo.), Sen. Styles Bridges (R., N. H.), and Sen Guy Cordon (R., Ore.). Russell commented: "We should concentrate on our atomic development and better bombers rather than waste arms and money overseas."

▶ **Fight Expected**—A fight to sustain the Senate slash, however, was anticipated. The Administration and the Joint Chiefs of Staff indicated they would stand pat for a 48-group USAF as adequate. Sen. Thomas (D., Okla.), chairman of the Senate conferees, and Sen. Chan Gurney (R., S. D.), ranking Senate Republican conferee on the military supply bill, announced they would insist on the Senate cutback.

Gen. Omar Bradley, chairman of the Joint Chiefs of Staff, summed up the Administration position which continues to have substantial support in the Senate: "We have anticipated it (that Russia would have the atomic bomb) for four years, and it calls for no change in our basic defense plans."

▶ **Other Results**—Other developments, touching on the future role of U. S. airpower, which followed the Presidential announcement were:

• **Congress promptly approved** $1.3 billion foreign arms program urged by the Administration, $1 billion of which will go to European signatories to the North Atlantic Pact. James Bruce, former ambassador to Argentina, now a director of American Airlines, is slated for appointment to administer the foreign arms program.

• **A speed-up in establishing** a U. S.-Canadian radar air warning network was anticipated. Legislation authorizing a $160,750,000 U. S. network has been enacted. The 1950 fiscal year USAF budget, however, allows only token funds to get the program underway. The move for a speed-up was touched off by Gen. George Kennedy who termed it a "must" now.

• **Congressional approval** of legislation authorizing a $311,000,000 supersonic wind-tunnel program, including $150,000,000 to initiate construction on an air engineering development center with an ultimate cost estimated at $1 billion, appeared assured at this session. The Senate and a House armed services subcommittee have approved it. The measure now awaits approval by the full Armed Services Committee and the House.

• **Islationist-minded congressmen** called for a revolution in U. S. defense strategy with over-riding emphasis on building up a long-range U. S.-based air arm and the atomic bomb stockpile. They called for a halt—or at least a radical cutback—of armament disbursements abroad under the policy of "containing" Russia. Their view, as expressed by Rep. Lawrence Smith (R., Wis.): "Everything we are doing except for airpower, will be going down the drain. The theory that we have to develop the ground forces of our allies to stave off a rush until we get there is nonsensical."

• **The congressional sentiment that prevailed,** however, points to an evolution in U. S. defense strategy under the mutual North Atlantic defense program now moving rapidly forward. The key role of the U. S. under the program, involving 10 European countries, Canada, and the U. S., will be strategic bombing. An increase in U. S. bomber strength based in Great Britain and atomic bomb stockpiling there eventually, are expected.

▶ **Defense Plan**—Here is the organization that has been set up to evolve the mutual defense plan:

• **North Atlantic Council,** composed of the foreign ministers of the 12 signatory countries, is the top-level policy body. Secretary of State Dean Acheson is the U. S. representative.

• **The Defense Committee,** composed of the defense secretaries of the member countries, is the intermediary policy body through which recommendations funnel to the council. It opened its organizational meeting in Washington last week.

• **The Military Committee,** composed of the chiefs of staff of the member countries (Gen. Bradley is expected to

represent the U. S.), is the body which will make final strategic determinations. Its "standing committee," composed of the chiefs of staff of the U. S., Great Britain and France, with permanent headquarters in Washington, is the heart of the organization. It will meet continuously, functioning similarly to allied commands of wartime.

• **Regional Planning Committees** will submit recommendations for specific defense of their area to the over-all military committee. The U. S. will be represented on each of the committees —Northern European (Denmark, Norway, Great Britain); Western European (Belgium, France, Luxembourg, the Netherlands, Great Britain); Southern European (France, Italy, Great Britain; Canada-U. S.).

Lockheed XF-90 Surpasses Mach 1

Big AF penetration fighter exceeds supersonic mark in level flight at Muroc, bettering design top speed.

By Robert McLarren

Lockheed XF-90 has flown faster than the speed of sound in level flight. The F-90 is the second tactical type in the world to do so and the fourth airplane to attain supersonic speed in level flight. The Bell X-1 (AVIATION WEEK, Dec. 22, 1947), Douglas D-558-II, both special research types (AVIATION WEEK, Oct. 3, 1949), and the North American F-86 (AVIATION WEEK, Sept. 12, 1948) have previously attained supersonic speed in level flight.

The 15-ton Lockheed penetration fighter (AVIATION WEEK, May 23, 1949) was flown by Lockheed chief engineering test pilot Anthony W. "Tony" LeVier in a maximum performance test over Muroc Air Force Base, Calif. The supersonic attainment exceeded the design performance of the airplane, which was "vicinity of sonic speed" at sea level.

▶ **Result Predicted**—This result had been anticipated by Lockheed engineers on the basis of afterburner performance obtained from a standard F-80 fighter.

XF-90 was originally planned to reach sonic speed by the use of auxiliary liquid-fuel rocket power, but was changed to incorporate solar afterburners on the dual Westinghouse J-34-WE-22 turbojet engine installation. This combination, under optimum conditions, produces a total thrust of about 12,000 lb., more than twice as much as any other U. S. fighter plane. (This is exceeded only by the 15,000 lb. thrust of a special experimental Gloster Meteor powered by two Rolls-Royce Avon engines.) Two standard JATO solid-fuel rockets are used on the XF-90 for takeoff.

Key to the supersonic performance of the XF-90 is this tremendous power plus razor-thin swept wings and tail. The huge fighter still retains its long-range capabilities as a penetration fighter through the use of a large internal fuel supply plus two 220-gal. tip tanks.

This combination gives the craft a maximum range of more than 2000 mi. at high altitude without calling into play the afterburners.

▶ **Afterburner Use**—Afterburner power, while essential for the attainment of supersonic speed, is costly in fuel consumption and can be used only for brief periods of several minutes duration. Typical operation is the use of afterburners for 2-3 min. for takeoff and climb to 30,000 ft., after which they are shut down and the climb continued to 50,000 ft. on jet engines alone. The afterburners can be used 3-5 min. during the 20-min. combat time at this altitude after which they are shut down and the descent made.

A feature of the XF-90 test program, since the first test flight early last June, has been its precision in meeting its schedule. Comparatively trouble-free throughout its test program to date, the huge fighter has been put through its paces exactly according to a pre-test schedule. Tony LeVier, after having hung up this supersonic speed mark, has turned over further test flights to other Lockheed test pilots, who will complete the current Phase I demonstration program. Air Force test pilots will then take charge for Phase II test flying.

Although this performance expresses graphically the capabilities of the XF-90, earlier test flight results had already decided Air Force in favor of its procurement and production is scheduled to begin in 1950.

Skyrocket Sequel

Although Navy by midweek had not officially confirmed the exclusive and authoritative AVIATION WEEK story of Oct. 3 that the Douglas D-558-II Skyrocket had flown faster than sound, plans for an elaborate Navy press and newsreel junket to Muroc Air Force Base to see the plane establish a new world speed record were temporarily postponed by the story. Navy plans for the event are uncertain at the moment.

Unitary Plan

Speedy congressional approval of wind tunnel program is expected.

Speedy congressional approval is predicted for legislation implementing the so-called "unitary plan" for wind-tunnel development by the Department of Defense and National Advisory Committee for Aeronautics. The House Armed Services Committee quickly voted the measure out last week, but scaled it down from the $311-million program approved by the Senate to a $176 million program. The discrepancy between the two programs will be threshed out by a joint conference committee, after the legislation has cleared the House.

The cutback did not reflect reluctance toward aerodynamic research. The House committee felt that authorization on two large wind tunnels proposed by NACA should be postponed until the committee had conducted further experimentation on smaller tunnels.

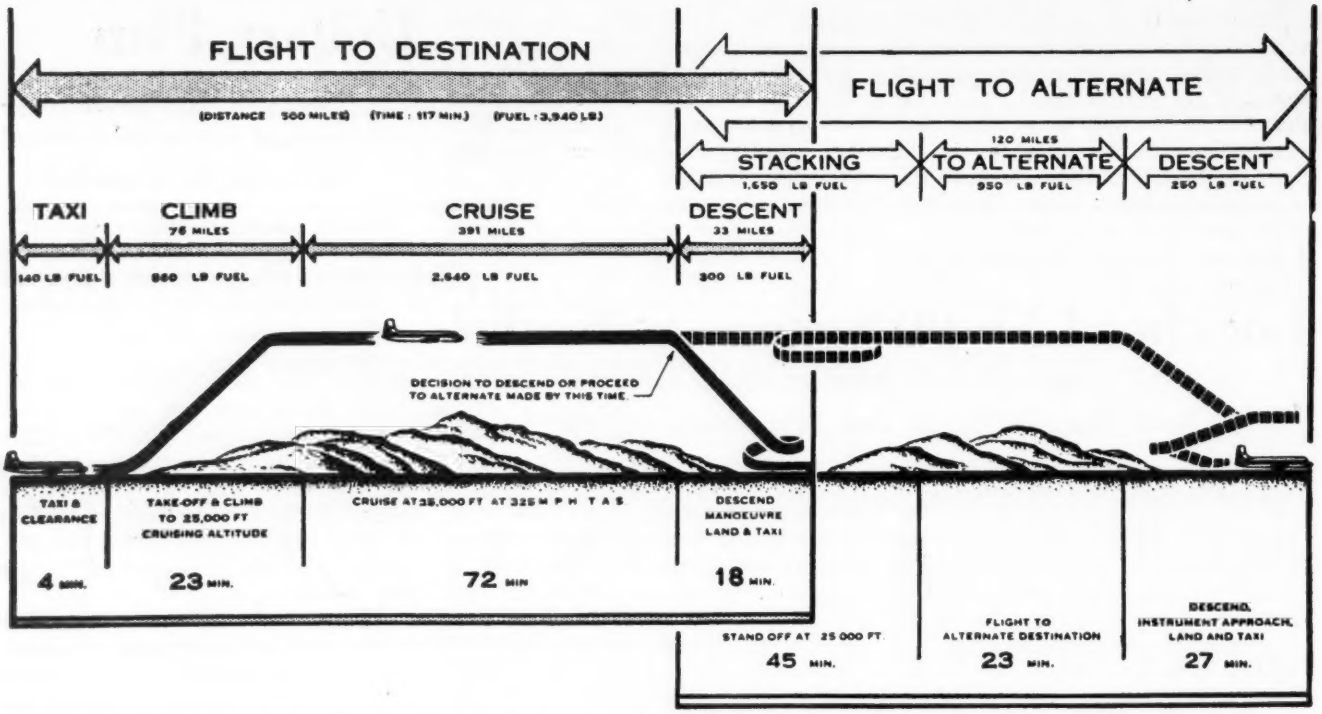
▶ **Tunnel Program**—The wind tunnel construction approved by the House committee was, as follows:

• **Universities, $10,000,000.** This includes wind tunnels for research work, as well as for training purposes. The universities at which the tunnels are to be installed will be chosen by NACA, which already has over 30 applications. The Senate allowed only $4,400,000.

• **NACA, $60,000,000.** This will enable NACA to construct two 2x2-ft. tunnels (at Langley Field and Ames Laboratory), totalling $12,804,000; two 4x4-ft. tunnels (at Langley and Ames), totalling $40,634,000; and utilities, totalling $6,562,000. The $317,000,000 program approved by the Senate would enable NACA, in addition, to construct an 8x8-ft. aerodynamic tunnel, costing $29,720,000, and an 8x8-ft. propulsion tunnel, costing $40,700,000.

• **Navy, $6,600,000.** This is for a 2x2-ft. tunnel at the David W. Taylor Model Basin. This was the same project approved by the Senate.

• **Air Force, $100,000,000.** This is to initiate construction on an Air Engineering Development Center, with an estimated ultimate cost of $1 billion. The Senate allowed $150,000,000. The House reduction affects auxiliary items, such as housing, utilities, etc. The three key installations at AEDC will be a hypersonic wind tunnel of "reasonable size," with a cost approximating $16,000,000; a supersonic propulsion tunnel, approximating $40,000,000; and an altitude chamber for testing jet engines, with a replacement value set at $13,000,000.



JET FLIGHT PLAN set up to take advantage of higher speed of this type of transport on 500-mile run has marked differences from . . .

How Jet Transport Earns Profit

Avro Jetliner designer outlines operational factors in belief that short-haul routes offer best opportunity.

By Robert Hotz

LONDON—It is no longer a question of whether turbojet transports will go into commercial airline service but rather when and where they will make their debut, according to Edgar H. Atkin, chief designer of A. V. Roe Canada Ltd.

Atkin is the designer of the Avro Jetliner powered by four Derwent turbojets that is now undergoing flight testing at Toronto. He presented his case for the turbojet transport in the fifth British Commonwealth and Empire Lecture of the Royal Aeronautical Society here recently.

► **Short Haul**—The turbojet transport will probably make its debut on the short haul inter-city routes of Australia and Canada, Atkin believes. Because of new traffic control and operational procedures required for turbojet transports, Atkin expects a period of operational experimentation prior to full schedule operations. Because of good weather, relatively simple route structures and traffic conditions, Australia and Canada offer the best areas for working out the economic and operational problems of the turbojet transport.

In urging use of the turbojet transport in short haul inter-city traffic, Atkin runs counter to the general trend of British thinking on this subject. Usual assignment gives the turboprop transport the short-haul role with the turbojet transport taking over only on long hauls over 1000 mi. Figures presented by Atkin in the accompanying tables are subject to considerable argument from the turboprop advocates.

► **Extreme Optimism**—Turboprop proponents contend that Atkin's calculations on the stacking fuel allowances for the turbojet transport are extremely optimistic and cannot be met in actual operations.

Atkins says that current trans-Atlantic air service now is strictly "third class." He sees as the only hope of improving it to shorten materially the time the passenger spends in the plane. On inter-city land travel, Atkin pointed out that the turbojet transport can complete a 1000-mi. round trip within 12 hours leaving approximately four hours at the halfway point for business while still allowing a return home in time for normal sleeping.

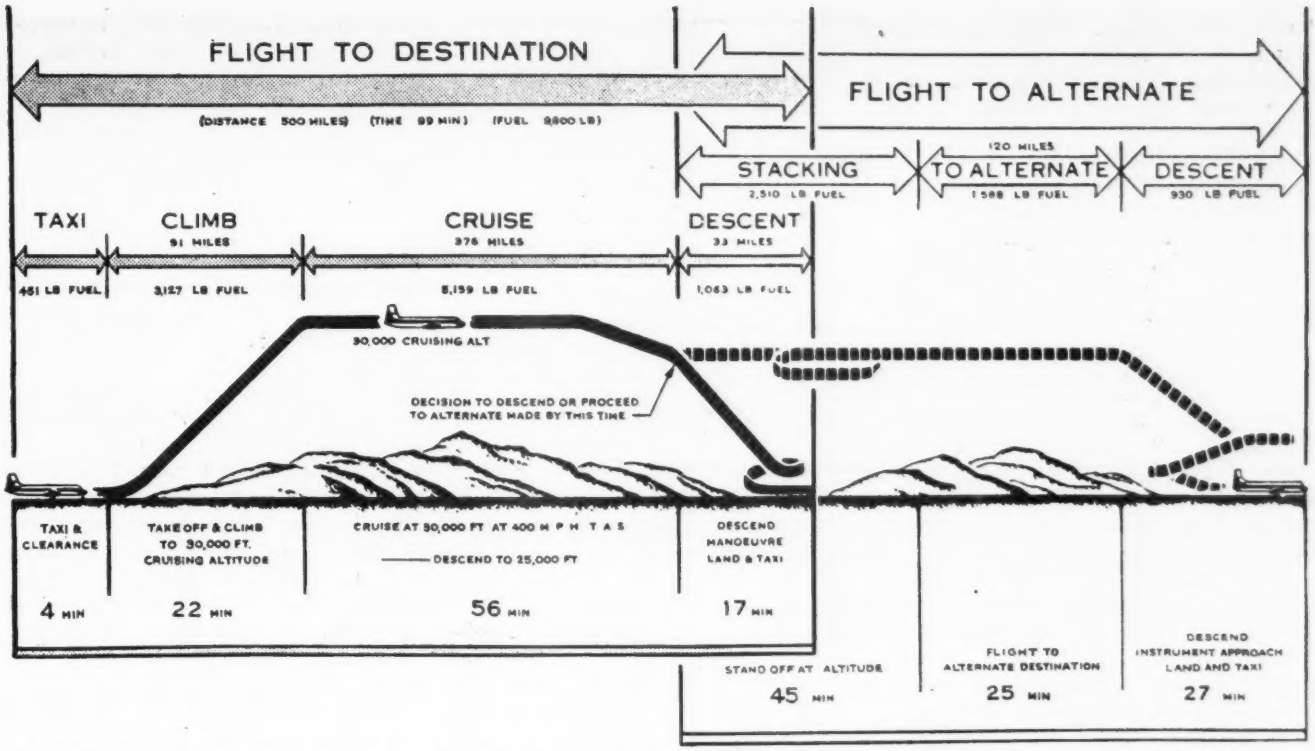
► **Interim Stage**—The turboprop interim stage is dismissed by Atkin as merely saddling the transport operator with equipment that will shortly become obsolescent. He feels that airline operators who have continued to operate DC-3, DC-4 and even DC-6 equipment on short hauls despite uneconomic aspects of such operations will likely hold out a little longer on equipment replacement if they can be assured that the new equipment will be suitable for a long operational period and will not soon be technically outmoded.

Atkin believes that both the turboprop and turbojet airliner are economically competitive with piston-powered airliners even under present operational conditions. Among the advantages offered by the turbojet transport Atkins lists the following factors:

• **Speed.** Increased speed will mean money for the airliner operator regardless of what happens to the passenger between airport and his final ground destination. The chief penalty for speed under present operating conditions is in the traffic control system that requires stacking in instrument weather and ground handling of the plane and passengers.

Atkin points out that because of a turbojet transport's high fuel consumption in taxiing and holding on the end of a runway awaiting take-off it may be necessary to start the engines only when take-off clearance has been issued. To do this it will be necessary to transport passengers from the terminal to the plane by bus and load off the end of the runway.

• **Economy.** Operating costs of the turbojet transport should be considerably lower than either the turboprop or piston-powered transports according to Atkin. He believes the assumption that airframe and equipment overhaul will be materially reduced by the lack of vibration from a turbojet is justified. He also believes that turbojet engines

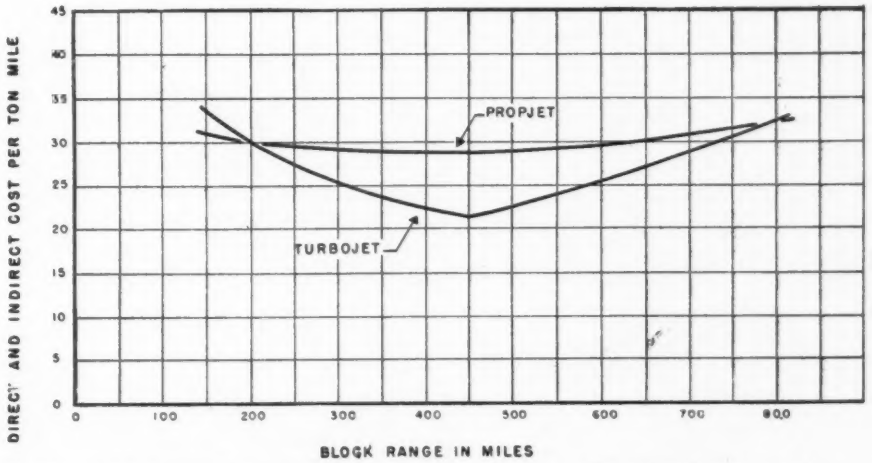


TURBOPROP FLIGHT PLAN. Climb to altitude is faster, cruising period is shorter, descent is faster. Best of all, says Atkin, . . .

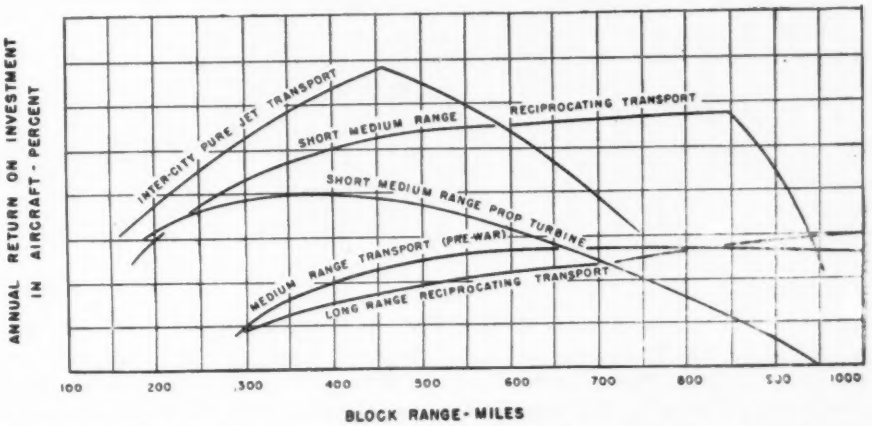
will begin their commercial life with an overhaul interval of between 750 and 1000 hr. On fuel consumption the turbojet plane is in a marginal position now for commercial operation but even with its present excessive fuel cost, Atkin believes it will earn more on a given route than present piston-powered transports. The turboprop is in a better position than the turbojet on fuel consumption at present, Atkin admits, but points out that the turbojet has the most to gain from improved fuel consumption devices such as variable intakes and tailpipes that will be feasible in the near future. Atkin's figures show that the turbojet has a marked superiority in combined direct and indirect operating costs over the turboprop transport at ranges between 200 and 700 mi.

• **Earnings.** Atkin points out that the optimum earning power of a turbojet transport is now in the 460-500 mi. range but that a 5 percent improvement in fuel economy would extend the optimum earning range by 70 mi. while a 10 percent increase in fuel economy would also increase the optimum earning range by 140 mi. with a 12 percent increase in return on investment. Improvements in turbojet fuel economy in the order of 20 percent are not in the too distant future, Atkin asserts. These improvements will be available for well within the lifetime of jet transports now emerging from the prototype stage.

Similar improvements in turboprop engines will not pay off on such a large economic scale, says Atkin, because the



COST of jet transport at about 500 miles is less than that of turboprop, and . . .



EARNING POWER is greater, based on 70 percent load factor, 5.5-cent-a-mile fare.

fuel cost of the turboprop transport is not such a large proportion of total cost as it is in the turbojet transport. He says an increase of 10 percent in turboprop fuel efficiency will mean an increase of only 50 mi. in range with scant improvement in earning power.

Atkin's figures on earning power of

transports indicates that the turbojet is best from 200 to 500 miles while the piston-powered transport is better at ranges over 500 miles. Earning power of the turboprop transport falls off sharply beyond 400 miles.

Atkin believes that a 40-60 passenger turbojet transport of between 40,000 and 60,000 lb. gross weight will pay off best for airline operators during the next decade since it gives the best compromise between aircraft size and traffic frequency. Atkin believes that the turbojet will pay off more on inter-city hauls than on international trunk hauls because traffic figures for most areas indicate that domestic traffic ranges from 5.6 and 3.8 to 1 in comparison with international traffic.

▶ **Need Size**—Turbojet transports must be of relatively large size to pay off both in range and payload, Atkin believes. He cites figures for a twin-Derwent transport of 28,000 lb. gross which can barely make a 500-mi. haul with extremely meager emergency allowances. On the other hand a 60,000-lb. four-Derwent transport can make the 500-mi. haul with fuel reserves to meet present-day traffic control requirements. This is interesting in view of the British trend toward experiments with twin- and four-jet transports (Tudor VIII and IX and Vickers Tay Viscount) for short-haul traffic. Reports on these tests will not be available for some time.

Atkin contends that an aircraft of 120,000 lb. gross weight is required to fly London-New York nonstop. It is believed that the de Havilland Comet now grosses considerably under this figure.

▶ **Counters Critics**—Atkin took issue with current criticism of the inflexibility of turboprop and turbojet operations as to cruise and altitude. He pointed out that the desired flexibility could be obtained by use of only three or two engines depending on the speed and altitude desired. In the case of stacking, the use of two engines will enable the turboprop or jet to maintain a holding pattern at various altitudes without severe penalty over the piston-powered transport.

However Atkin's contention that a turbojet will be able to hold at relatively high altitudes where its power plants are more efficient has aroused considerable comment from turboprop advocates who contend that stacking in present traffic control systems must be done at much lower altitudes where turbojet efficiency falls off considerably.

Atkin points out that in many cases the decision to send a turbojet transport to an alternate airport because of weather can be made while the plane is still at its optimum cruising altitude and fuel need not be wasted in descent to observe weather and climb back to cruising altitude if the field is not suitable for a landing. This of course implies a stronger ground control over aircraft in flight than is now customary in commercial airlines.

▶ **Speed Difference**—Atkin also differs with British turbojet experts who are counting on 500 mph. cruising speed for the Comet. Atkin believes that it will be some time before 500 mph. cruising speeds are attainable and that 400-450 mph. speeds are more feasible for the immediate future.

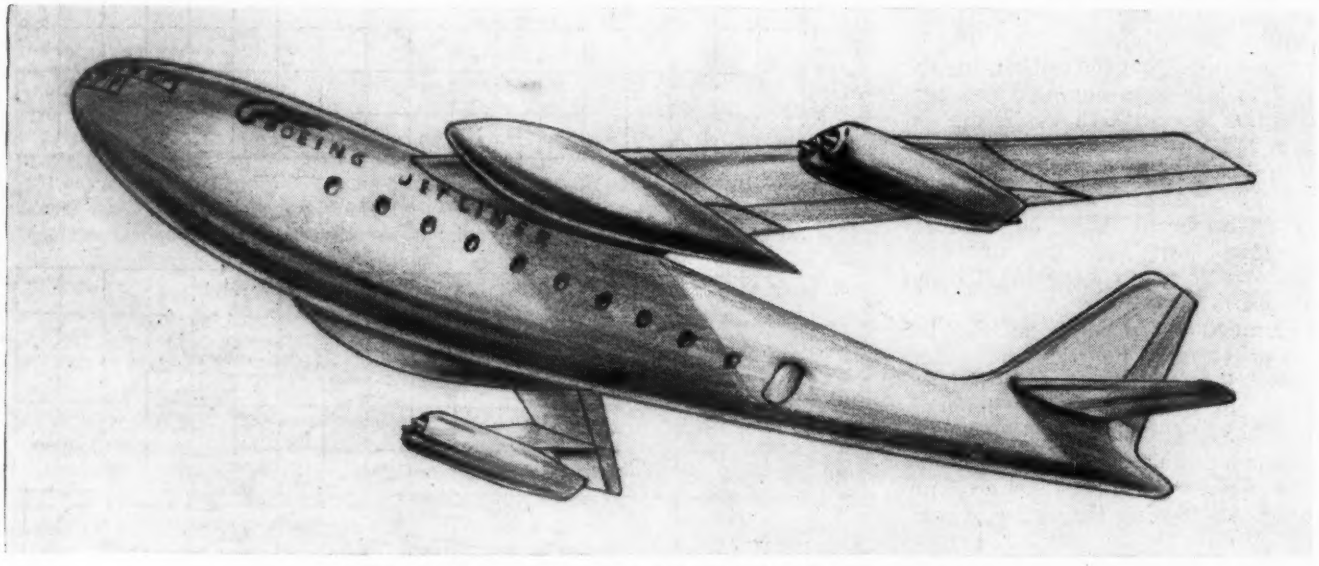
What 75S Offers

Beginning on page 21 of this issue, AVIATION WEEK presents an exclusive analysis of 75S, one of the key materials in modern aircraft construction. Designers and operators of high-performance planes will find this comprehensive report a valuable source of reference data to promote a better understanding and more sound usage of this high-strength aluminum alloy, particularly from the standpoint of fatigue.

NEA Hits Peak Month

Northeast Airlines this year had its most profitable August in company history. Earnings of $130,625 brought the carrier's total operating profit for the first eight months of 1949 to $149,956, compared to a $746,477 loss in the same 1948 period.

Meanwhile, NEA reported it paid Consolidated Vultee Aircraft Corp. $504,000 for the new Convair-Liner it bought to replace one lost in an accident at Portland, Me., during August.



500 MPH. JET TRANSPORT IN 18 MONTHS?

Here is an Aviation Week artist's conception of the proposed Boeing jet transport plane, recently discussed by Wellwood Beall, Boeing vice president-engineering and sales, who stated his company could develop to flight test stage such a plane prototype in 18 months on basis of designs now on the drawing board. Plane could be adapted to ranges of 200 to 2500 mile routes, with accommodations for 38-40 passengers. It would cruise at 500 mph. Sketch shows a logical transport adaptation from the Boeing B-47 six-jet bomber, using identical swept-back wing and tail surfaces. Four jet powerplants are slung below the wing at the outboard "pod" stations in two double nacelles. Two huge fuel tanks are suspended at what are inboard powerplant stations on the B-47, leaving the fuselage space open for passengers and cargo. (No room is available in the thin B-47 wing for fuel tanks.) Missing from the transport version are the built-in jet-assisted takeoff installations near the tail of the B-47. Plane would presumably use the same tandem main landing gear retracted into fuselage, with smaller "outrigger" wheels. Still to come: an airline or government order.

First Flights

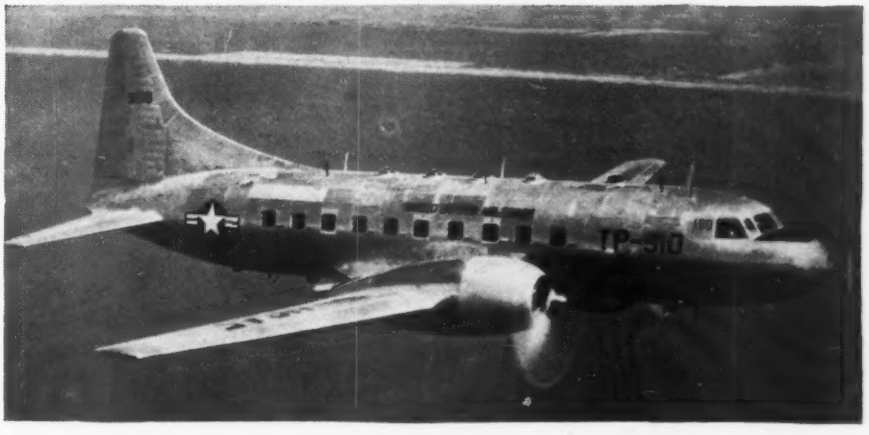
Douglas DC-6A, North American and Convair USAF trainer tested.

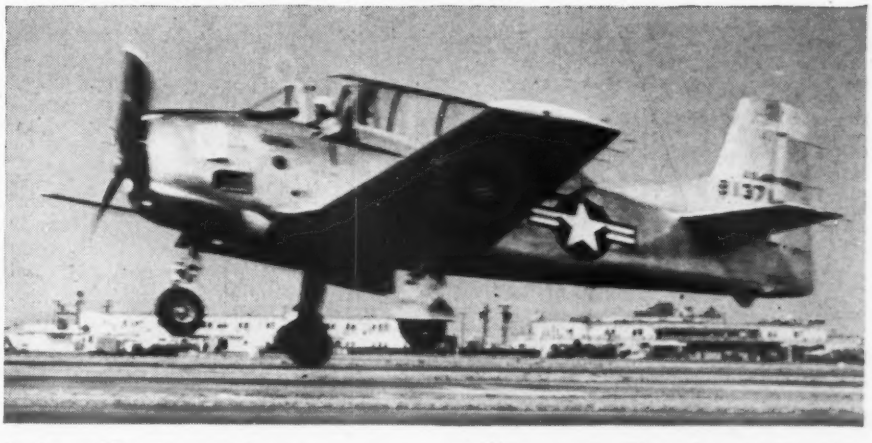
Three important new airplanes took to the sky for successful maiden flights at three West Coast plants within the last fortnight.

• **Douglas Aircraft Co.** launched its new bid for commercial air freight business, the four-engine DC-6A Liftmaster (top) at Santa Monica, before the interested eyes of Bob Prescott, Flying Tigers president; Tom Grace, Slick Airways vice-president, and Ron George, KLM representative.

• **Consolidated Vultee Aircraft Corp.** put its new Air Force navigational trainer (developed from the Convair 240 Airliner), the T-29 (center), equipped with 14 complete navigator's stations, into the air at San Diego for a 15 min. test flight cut short by fog.

• **North American Aviation Inc.** sent up its 800 hp. T-28 Air Force trainer (bottom) at Los Angeles Municipal Airport for a 45-minute "warmup" two weeks ahead of the planned production schedule.





The DC-6A, five feet longer in fuselage than its predecessor the DC-6, strictly a Douglas investment at this point, will soon be the objective of an intensive sales campaign. Liftmaster has gross weight of 97,000 lb. and payload of 30,000 lb. Powerplants are four Pratt & Whitney R-2800 CA-17s rated at 1800 hp. each.

Convair has USAF orders for 36 new navigation trainers of the T-29 type, enough to put 500 student navigators and their instructors out on a flight problem at one time.

▶ **No Pressurization**—R. C. Loomis, Convair San Diego manager of inspection and flight, and E. D. Shannon were pilot and co-pilot on the first flight.

USAF has ordered 268 of the North American T-28s capable of 288 mph. top speed and with the same cockpit arrangement as high-speed operational jet fighters and bombers. Normal cruising speed is 166 mph. with 72 mph. stalling speed. Plane has 40 ft. wingspan, is 32 ft. long. Rate of climb is 2,570 ft.-min. Maximum range is 1008 mi., and service ceiling is 29,800 ft. Complete flight controls and instruments are provided in both cockpits. Powerplant is a Wright R-1300 engine. Other features: tricycle gear with steerable nosewheel; 12.5 degree visibility range over nose; powerplant installation, and airframe designed for easy maintenance.

PRODUCTION

Latest Air Force Bid Awards

Air Materiel Command procurement Division makes available to AVIATION WEEK the latest bid awards, shown on this page. Requests for further information should be addressed to Contracting Officer, AMC, Wright-Patterson AFB, Dayton, Ohio, attention: MCPPSX72.

ABSTRACTS

For release bomb rack (49-2451):
Hawthorn Manufacturing Co., Kansas City, Mo., on a bid of $159,341.08.

For shop field maintenance (49-2315):
Jumbo Steel Products Co., Azusa, Calif., on a bid of $77,000.

For transmitter indicator (49-2506):
Eclipse-Pioneer Division, Teterboro, on a bid of $159,862.56.

For indicator (50-5):
General Electric Co., Schenectady, on a bid of $8702.02.

For ball bearings (50-24):
Companies sharing—General Motors Corp., Bristol, Conn., on a bid of $14,400, and Barden Corp., Danbury, Conn., on a bid of $85,500.

For hose (50-34):
Companies sharing — Weatherhead Co., Cleveland, on a bid of $2625, and United States Rubber Co., New York, on a bid of $47,974.33.

For parachute assembly components (50-52):
Companies sharing—Kay Rubber Co., New York, on a bid of $12,462; Thomas Taylor & Son, Inc., Hudson, Mass., on a bid of $4218.49; B. F. Goodrich Co., Akron, on a bid of $7332.25; Linear, Inc., Philadelphia, on a bid of $1173.99; Hydropack, Los Angeles, on a bid of $1177.10, and M. J. Gibbons Supply Co., Dayton, on a bid of $96.80.

For compressors (49-2134):
Companies sharing — Davey Compressor Co., Kent, O., on a bid of $52,796, and Browning Brothers, Inc., New York, on a bid of $576.92.

For relay assembly (49-2503):
Companies sharing—General Electric Co., Schenectady, on a bid of $7998, and Hartman Electrical Mfg. Co., Mansfield, O., on a bid of $5910.50.

For mount assemblies (50-12):
Piper Aircraft Corp., Lock Haven, Pa., on a bid of $4809.63.

For 139,400 square feet rubber sponge (50-36):
Companies sharing — Western Rubber Prod. Co., Southgate, Calif., on a bid of $220; B. F. Goodrich Co., Akron, on a bid of $4840, and United States Rubber Co., New York, on a bid of $1460.57.

For hose (50-37):
Companies sharing—Hewitt Rubber Div., Hewitt-Robins Inc., Buffalo, on a bid of $2287.50; Goodyear Tire & Rubber Co., Inc., Akron, on a bid of $2279, and United States Rubber Co., New York, bid of $29,255.75.

For radar transmitters (49-1711):
Companies sharing—Midwest Engineering Development Co., Inc., Kansas City, Mo., on a bid of $86,331.20, and W. L. Maxon Corp., New York, on a bid of $30,995.07.

For radio adapters (50-2):
Companies sharing—Selectar Industries, Inc., New York, on a bid of $1530.72; Kann-Ellert Electronics, Inc., Baltimore, on a bid of $126.87; Kings Electronics Inc., Brooklyn, on a bid of $2200.10, and Telectro Industries Corp., Long Island City, N. Y., on a bid of $825.

For indicators (50-26):
Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, on a bid of $3529.20.

For plastic sheets (50-29):
Nixon Nitration Works, Nixon, N. J., on a bid of $21,864.61.

For 1430 metal swivel chairs (49-2189):
Companies sharing—Charles G. Stott & Co., Inc., Washington, D. C., on a bid of $12,351; Globe-Wernicke Co., Washington, D. C., on a bid of $3982.35; Crown Office Supply Co., Chicago, on a bid of $6369.75, and Roth Office Equip. Co., Dayton, on a bid of $2205.

For trainers (49-2016):
Companies sharing—Management & Research, Inc., Primos, Pa., on a bid of $1579; G. Felsenthal & Sons, Inc., Chicago, on a bid of $2310.55; G. W. Holmes Co., Columbus, O., on a bid of $7318.60, and American Automatic Typewriter Co., Chicago, on a bid of $44,280.

For alternators and exciters (50-41):
Companies sharing—Eicor, Inc., Chicago, on a bid of $79,565, and Gaveco Laboratories, Inc., New York, on a bid of $78,125.

For hose (50-43):
Companies sharing — Aeroquip Corp., Jackson, Mich., on a bid of $34,515; United States Rubber Co., New York, on a bid of $52,664.23; Manhattan Rubber Div., Raybestos-Manhattan Inc., Passaic, N. J., on a bid of $2992.50; Goodyear Tire & Rubber Inc., Akron, on a bid of $22,160.50; B. F. Goodrich Co., Akron, on a bid of $15,549.98, and Hewitt-Rubber Div., Hewitt Robins Inc., Buffalo, on a bid of $16,281.

For hammers (49-2157):
American Pneumatic Tool Co., Los Angeles, on a bid of $7631.25.

Invitations to Bid

Bid openings are 20-30 days after approximate issue dates shown in the following bid proposals. Bid sets containing specifications for items to be procured will be sent to qualified applicants who state bid invitation number.

One bid set will be available for examination without obligation by prospective bidders, after bid publication date, at each of the seven AMC procurement field offices. This will enable firms to see specifications before writing or telegraphing for their own bid sets.

Procurement field office locations: Boston Army Base, Boston 10, Mass.; Government Aircraft Plant No. 4, Ft. Worth 1, Tex.; 39 S. LaSalle St., Chicago 3; Wright-Patterson AFB, Dayton, Ohio; West Warren and Longo Aves., Detroit 32; 155 W. Washington Blvd., Los Angeles; 67 Broad St., N. Y. 4.

INVITATIONS

Connector Assembly, 1-6 items, bid invitation No. 50-163, issue date Oct. 3, 1949, delivery by March 1950.

Cowling Fasteners, 1-8 items, bid invitation No. 50-159, issue date Sept. 28, 1949, delivery by Feb. 1950.

Hardware, Aircraft, 1-8 items, bid invitation No. 50-165, issue date Oct 3, 1949, delivery by Feb. 1950.

Hardware, Miscellaneous, 1-7 items, bid invitation No. 50-164, issued date Oct. 3, 1949, delivery by March 1950.

Naphthalene, 20,000 pounds, bid invitation No. 50-162, issue date Oct. 3, 1949, delivery in 30 days.

Photographic Equipment, 1-35 items, bid invitation No. 50-157, issue date Sept. 27, 1949, delivery by Nov. 1949.

Silver, Cyanide, 1-2 items, bid invitation No. 50-166, issue date Oct. 3, 1949, delivery 30 days.

Turnbuckle Assembly, 1-10 items, bid invitation No. 50-161, issue date Oct. 3, 1949, delivery by March 1950.

Navy Bid Proposals

The following bid invitations have been announced by the Navy Dept. Aviation & Supply Office at Philadelphia. Bid forms may be obtained from the Aviation & Supply Office, Oxford Ave. and Martin's Mill Road Philadelphia. Specifications are not furnished unless requested by number.

Roller bearings, radial, 2 sizes, aircraft control and pulley; invitation No. 8649; bids due Oct. 20.

Fillister head screws, 51 items; specs. FF-S-91, AN-S-52a, dwgs, AN500, 501, 503; invitation No. 8513; bids due Oct. 21.

Cement, 2700 gal. deck covering, 3500 gal. ditto; 3800 gal. adhesive cement, type B.; 3450 gal. fire-resistant coating; 2000 gal. linoleum; 750 gal. synthetic rubber-to-metal; specs. 27-D-11, 52-C-23a, 52-C-46, -5d, -15; invitation No. 8525; bids due Oct. 21.

Electrical supplies, 4 items box connectors, angle and straight; 4500 conduit fittings; 3000 box covers, 4 in. octagon, galv.; 2000 outlet box covers; invitation No. 8547; bids due Oct. 10.

Blank carbon packing, 2200 ea., grade II, 9x9x11½ in.; spec. 33-P-18d; invitation No. 8581; bids due Oct. 25.

Stuffing and terminal tube packing, 1000 lb., part B, 5/16 in.; 1600 lb. part A, 3/16 in., spec. JAN-P-534; invitation No. 8583; bids due Oct. 24.

Packing, 3500 lb. class I, type B, ½ in.; 800 lb. class II, type C, 3/16 in.; 850 lb. ¼ in., Navy spec. 33-P-25c; invitation No. 8584; bids due Oct. 24.

Compressed asbestos sheet packing, 63,500 lb., 1/16 in. thick, Navy spec. 33-P-13c; invitation No. 8585; bids due Oct. 24.

Corrosion preventive compound, soft film, type I, 48,575 gals., spec. AN-C-124a; invitation No. 8589; bids due Oct. 11.

Tapered roller bearings, 11 items, complete assemblies; invitation No. 8606; bids due Oct. 25.

Liquid drier, concentrated, 2700 gal. type II, cobalt naphthenate solution; 12,000 gal. type I, lead naphthenate; 1600 gal. type III, manganese naphthenate, spec. TT-D-643; invitation No. 8607; bids due Oct. 24.

Metallic ladder treads, 2 sizes, 3 types, dwg. S1604-860041, spec. 47-S-18c; invitation No. 8615; bids due Oct. 25.

Fire extinguisher parts, 500 nozzle tips, for 3 position nozzles; 15,000 locking pins; 200 ⅜ in. cast bronze pulleys; 100,000 lead and wire seals, squeeze grip valve part; 10,300 Navy squeeze grip valves, spec. 45-V-13, BuShips dwg.; invitation No. 8621; bids due Oct. 17.

Roller bearings, needle, drawn shell, 12 items; invitation No. 8623; bids due Oct. 21.

Wood meat blocks, 25 ea., 30x30x16 in., size 3, spec. NN-B-476; invitation No. 8626; bids due Oct. 25.

Aluminum alloy sheets, 10,000 lb. .064x 36x96 in.; 5900 lb. .051x48x144 in., class A, ¼ H, spec. 47-A-11c; invitation No. 8636; bids due Oct. 24.

Flat head wood screws, 8 sizes, brass, type A, spec. 42-S-1i; invitation No. 8643; bids due Oct. 24.

Pressure transmitter, 1 ea., to measure gauge pressure up to 500 psi. under rapid transient conditions, Statham Labs. model; invitation No. 8646; bids due Oct. 21.

Ventilation valves, 100 ea. 5 in., 20 ea. 6 in., type A, special gate, hydr. bronze, BuShips dwg. 257543; invitation No. 8647; bids due Oct. 25.

Audio range filter assemblies, 60 ea., electrical spec., used in AN A1A2A, Bendix; invitation No. 8657; bids due Oct. 12.

Double strength window glass, type B, 10 sizes, spec. DD-G-451; invitation No. 8695; bids due Oct. 20.

TANK LIQUID LEVELS POSITIVELY CONTROLLED

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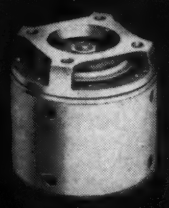

1¼" bottom-filling valves as used on Republic F-84 Thunderjet.

¾" top-filling valve with mounting flange as used on McDonnell F-2H Banshee.

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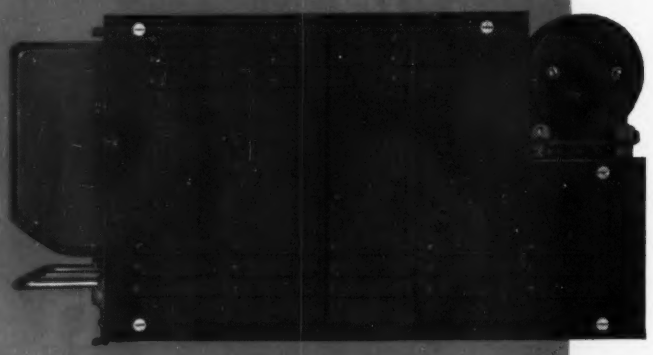


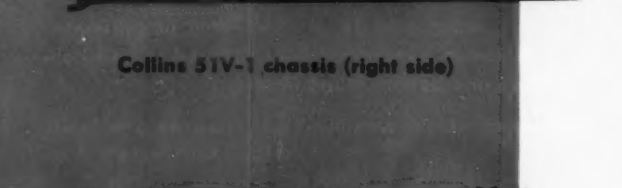
51V-1 glideslope receiver, covers in place

Glideslope Receiver

51V-1

...inside and out

Collins 51V-1 chassis (right side)



Collins 51V-1 chassis (left side)

THIS is the new Collins 51V-1 glideslope receiver for aircraft. Note the orderly design, and the accessibility of all tubes, components, and wiring.

The 51V-1 provides reception of 90/150 cps tone modulated glideslope signals on any of the twenty channels in the uhf range of 329-335 mc. This receiver together with Collins 51R navigation equipment will fulfill ILS receiving requirements for military, commercial and private aircraft. The design of the 51V-1 is based on "Glideslope Receiver Characteristics" issued by Aeronautical Radio, Inc., and on U. S. Airforce specifications.

Output circuits of the 51V-1 receiver feed standard ID-48ARN deviation indicators including flag alarm. By means of the flag alarm the pilot has a positive indication of the reliability of the glideslope signals and instrumentation.

The 51V-1 control circuits are integrated with the standardized R/θ channeling system with channel selection provided by means of a Collins 314U remote control unit.

More complete information, in the form of an illustrated bulletin, is yours on request.

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How to Use High-Strength Aluminum Alloy

Alcoa research engineers present complete study of material to serve as reference for aircraft industry.

By E. C. Hartmann,
F. M. Howell and
R. L. Templin

Aluminum Research Laboratories,
Aluminum Co. of America.

Official Report

For a number of years, 75S aluminum alloy has been a major aircraft structural material. Its properties and characteristics, its advantages and limitations, in conventional aircraft are widely known. But little known, as yet, is the performance of this alloy in high speed aircraft, particularly from the standpoint of fatigue. Because of many requests from the airframe and airline industries and military services, the Aluminum Co. of America has prepared for publication in AVIATION WEEK this article to serve as a ready reference in modern applications of 75S and comparison with 24 and 14S.

During World War II, there were in this country three high strength aluminum alloys used in aircraft for the main structural members, 24S, 14S, and 75S. The first two are essentially aluminum-copper alloys, the third an aluminum-zinc-magnesium alloy. Their tensile strengths ranged from 64,000 to 88,000 psi., with yield strengths from 42,000 to 78,000 psi.

These alloys are characterized by relatively high ratios of yield to tensile strengths—ratios ranging from about $\frac{3}{4}$ to $\frac{8}{9}$. As their yield strengths approach tensile strengths, lower ductility values are obtained and more difficulties are experienced in forming or fabricating components made from these materials.

▶ **Design Considerations**—Although the static strengths of these alloys have been improved considerably over the previously available high strength aluminum alloys, yet their fatigue strengths have not been improved proportionately.

Consideration of static properties only in selecting design stresses may in some instances lead to use of values beyond the fatigue strengths of the alloys, particularly because of the usual presence of stress concentrations in machines and structures.

These facts merit particular attention by those designing structures of these materials when repeated loading conditions are expected in service.

The most important and most generally used aluminum alloy in aircraft structures today is 75S. In this discussion, it will be used as a specific example in developing information intended to be helpful to designers working with high strength aluminum alloys.

It now appears that any further improvement of the higher strength alloys probably will involve modifications of the aluminum-zinc-magnesium-copper alloys currently represented by 75S.

▶ **Basic Makeup**—The alloy 75S contains approximately 90 percent aluminum, 5.6 zinc, 2.5 magnesium, 1.6 copper and 0.3 percent chrominum.

It is commercially available as sheet, plate, wire, rod, bar, extruded shapes, forgings and as Alclad sheet and plate.

Resistance of 75S to corrosion is quite similar to that of 14S and 24S. Freedom from susceptibility to stress corrosion cracking, which for years prevented commercial exploitation of alloys of this class containing zinc, magnesium, and copper, was obtained by proper choice of the proportions of these elements and addition of chromium, serving as a stabilizing agent.

Use of a coating metal, 72S, containing a small amount of zinc, for making Alclad 75S, provides the requisite anodic protection to the core of Alclad 75S sheet and plate.

Articles have been published describing the heat treatment of 75S alloy products and some of these are indicated in the list of references appended here. In one of these articles (Ref. 7), there is considerable discussion of the formability of Alclad 75S compared to Alclad 24S, as well as of spotwelding of the material.

▶ **Forming**—In the annealed condition 75S has good forming characteristics, but because of its higher yield strength more force is required to form it than other annealed aluminum alloys.

In the freshly quenched condition, tensile and yield strengths change very little during the first hour. From then on, tensile and yield strengths increase (Fig. 1).

The material is quite workable during the first two hours after quenching and this characteristic can be retained for longer periods by refrigeration.

In the fully heat treated and aged condition the material is less workable than most other aluminum alloys. Some forming can be carried out although, in general, larger bend radii should be used. Dimpling of Alclad 75S-T6 sheet for flush riveting can be performed with suitable tools.

Forming of 75S products at moderately elevated temperatures (250 to 300 F.), has been found advantageous in some instances without any deleterious effects on the material's mechanical properties or corrosion-resistance.

▶ **Tensile Properties**—While the foregoing items must be given consideration by the structural designer, we are concerned here primarily with the mechanical properties of 75S. Table I shows the minimum guaranteed tensile properties in the various tempers and also various typical properties.

Typical tensile and compressive stress-strain curves for Alclad 75S-T6 flat sheet and plate and for extrusions are shown in Figs. 2 and 3. Also included in these figures are tangent modulus curves for compression loading.

Tables II and III show the tensile properties of 75S products at various temperatures ranging from —320 to 700 F. It may be noted that the tensile and yield strengths are reduced considerably at 300 F. but that there is no embrittlement of this alloy at subzero temperatures.

▶ **Modulus Values**—Modulus of elasticity in tension is 10,300,000 psi., in compression 10,500,000 psi. It is, therefore, generally satisfactory to use an average value of 10,400,000 psi. for this alloy.

Modulus of rigidity is approximately 3,900,000 psi. and Poisson's ratio is about $\frac{1}{3}$.

Modulus values at subzero temperatures are slightly higher than at room temperature, while at elevated temperatures, they are reduced. Extent of these variations is indicated in Table IV.

Effects of exposure to elevated temperatures upon tensile properties at room temperature are indicated in Table V.

▶ **Fatigue Factors**—Fatigue strengths of 75S-T6 products, determined from rotating-beam fatigue tests of polished smooth specimens, are indicated in Table VI.

In general, 75S-T6 may be considered to have an endurance limit of about 24,000 psi., based on 500 million cycles of completely reversed stress. Test results have been slightly higher (26,000 psi.) than this for rolled-and-drawn rod and for forgings, and slightly lower (22,500 psi) for plate and extrusions.

These values are definitely higher than for any other commercial aluminum alloy. Comparisons with 24S-T4, 14S-T4 and 14S-T6 are shown in Table VI.

▶ **Fatigue Tests**—Repeated flexure fatigue tests have shown that the fatigue strength of 75S-T6 sheet is somewhat higher than that of 24S-T3 and 24S-T36 sheet for large numbers of cycles. For relatively small numbers of cycles, 75S-T6 sheet appears to be somewhat lower than the 24S.

The coating reduces the fatigue strength of Alclad 75S-T6 sheet to about the same level of fatigue strengths as Alclad 24S-T3 and Alclad 24S-T36. For large numbers of cycles of repeated flexural stress, Alclad 14S sheet is superior to Alclad 24S and Alclad 75S sheet. Table VII shows the flexural fatigue strengths of these alloys in sheet form.

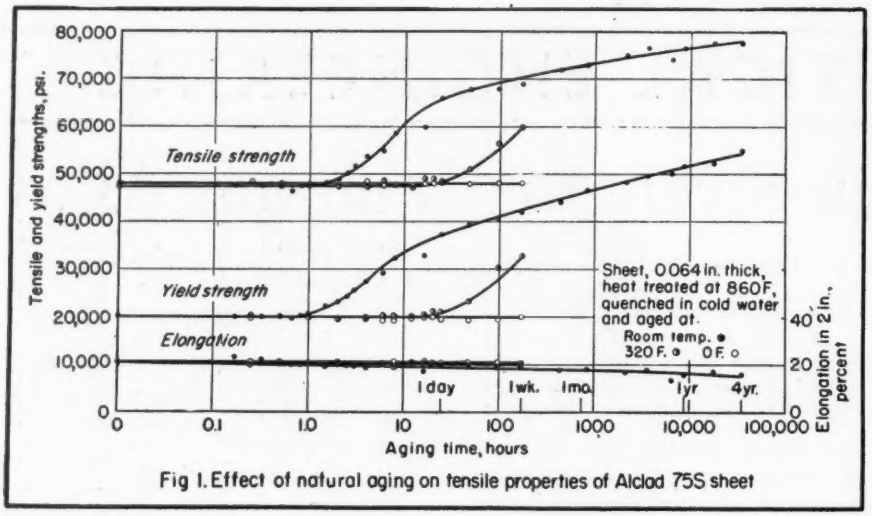

Fig 1. Effect of natural aging on tensile properties of Alclad 75S sheet

Direct tension-compression fatigue test results of smooth round specimens of 75S-T6, 24S-T4, and 14S-T6 are shown in Table VIII, torsion fatigue values in Table IX.

Cantilever-beam fatigue test values at elevated temperatures, given in Table X, have brought out what was indicated by tensile tests at elevated temperatures; the properties of 75S-T6 are lowered to a greater extent at 300 F. than are those of 24S-T4 and 14S-T6. At 400 and 500 F. the differences between the three materials are not clearly defined.

▶ **Notched Specimen Tests**—Rotating-beam fatigue tests of sharply notched specimens at room temperature show that 75S-T6 products are quite sensitive to severe stress concentrations. The notch used in these tests is a sharp (60-deg.) V-form having a depth of .075 in., with a radius at the root of approximately .0002 in. Diameter of the specimen at the root is 0.330 inch. In the presence of such a notch, the endurance limit is 6500 to 8500 psi.

While 75S-T6 suffers a greater reduction in fatigue strength as a result of this severe notch than other strong aluminum alloys, its actual notch fatigue strength is of the same order as that of 14S-T6, as shown in Table XI. Both 14S-T6 and 75S-T6 are more notch-sensitive than 14S-T4 and 24S-T4, which are not artificially aged.

In general, increases in yield and tensile strengths accompanying artificial aging are not accompanied by increases in fatigue strengths, and the artificially aged wrought alloys have their fatigue strengths reduced more by notches than do the naturally aged alloys.

This has been borne out by fatigue tests of riveted joints. These showed that joints in 75S-T6, 24S-T81 and 24S-T86 Alclad sheet, all artificially aged, have slightly lower fatigue strengths than similar joints in Alclad 24S-T3 sheet.

In general, then, it should be recognized that 75S-T6 is definitely more sensitive to severe stress concentration than 14S-T4 and 24S-T4, but not much different in this respect from 14S-T6, 24S-T81 and 24S-T86. Furthermore, fatigue strength of 75S-T6 in the presence of stress raisers is essentially the same as that of other high strength aluminum alloys artificially aged.

▶ **Static Notch Sensitivity**—Design of 75S-T6 aircraft structures for static loads follows the same pattern as for other metals. Because of the relatively high design stresses it is likely that more attention will have to be given to deflections and deformations than would be the case for the lower strength materials. These are matters, however, that introduce no new problems into design procedures and require no special comment here.

Question of static notch-sensitivity is sometimes raised in connection with 75S-T6. Generally speaking, designers have in the past paid little attention to static notch-sensitivity because experience has shown that metals which had been used structurally in aircraft perform very satisfactorily without any special attention to this item.

All designers realize that in the presence of notches, holes, and reentrant corners a stress concentration exists, but they also realize that under static load conditions these stress concentrations do not greatly influence the breaking load of the piece.

Structural metals, in general, have sufficient ductility to permit considerable plastic deformation to occur at points of stress concentration, thus preventing premature static load failures. The alert designer however, bears in mind that it is not safe to assume that this desirable property of metals will automatically carry over to each new material. Instead he will attempt to satisfy himself on the question of static notch-sensitivity before he proceeds very far with a new material. With 75S-T6 there seems to be little to fear on the score of static notch-sensitivity.

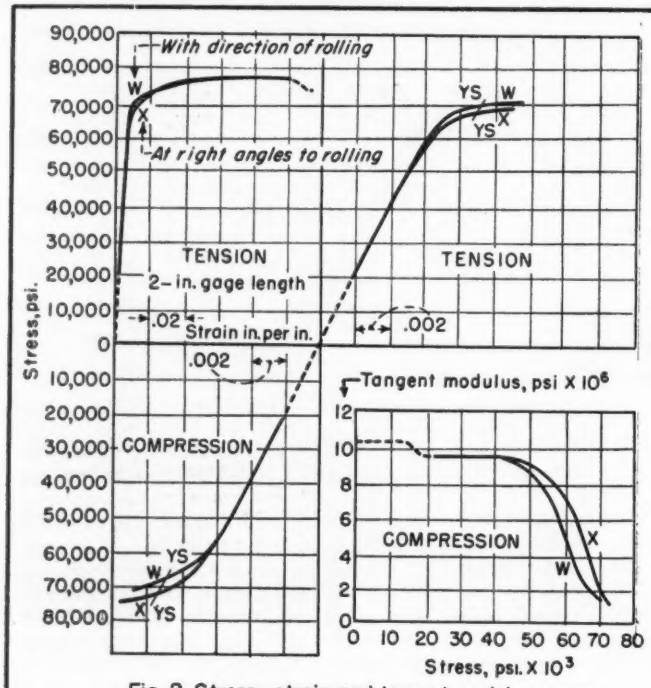

Fig. 2. Stress-strain and tangent modulus curves for Alclad 75S-T6 sheet and plate

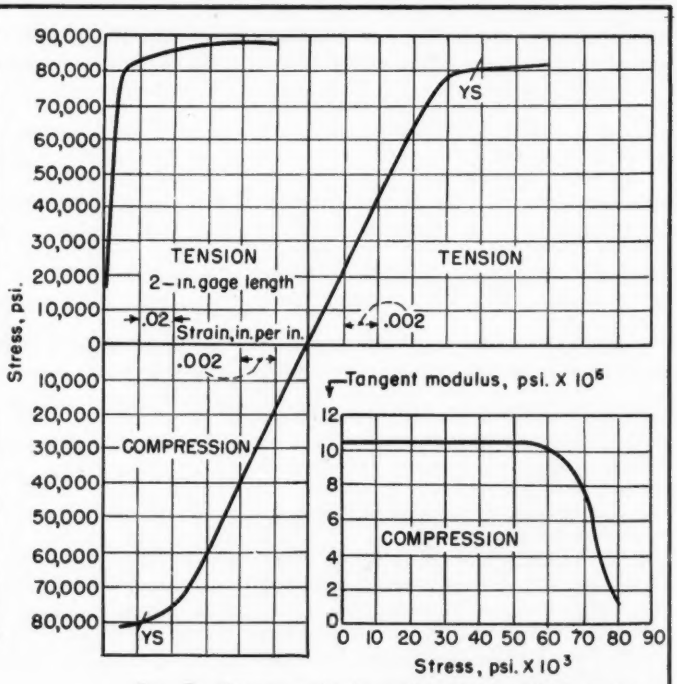

Fig. 3. Stress-strain and tangent modulus curves for 75S-T6 extrusions

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STANDARD OIL COMPANY (INDIANA)

Table I—Properties of 75S Alloy Sheet, Plate, Wire, Rods, Bars, Extrusions and Forgings

Property	Sheet and Plate*					Wire, Rods and Bars (Rolled or Cold-Finished)			Extrusions				Die Forgings 75S-T6	Hand Forgings†† 75S-T6					
									75S-O	75S-T6				Up to 16 Sq. In., Incl.		Over 16 to 36 Sq. In., Incl.		Over 36 to 144 Sq. In., Incl.	
	Alclad 75S-O	Alclad 75S-W (1 Hr.)†	Alclad 75S-T6	75S-O	75S-W (1 Hr.)†	75S-T6	75S-O	75S-W (1 Hr.)†	75S-T6	Up to 0.249 In.	0.250-2.999 In.	3.000 to 4.499 In. Area Up to 20 Sq. In.	3.000 to 4.499 In. Area 20 to 32 Sq. In.	Length 3W and Less	Length More Than 3W	Length 3W and Less	Length More Than 3W	Length 3W and Less	Length More Than 3W
Tensile Strength, psi.																			
Typical	32,000	46,000	76,000	34,000	49,000	82,000	34,000	50,000	84,000	88,000	88,000	87,000	84,000	82,000	81,000	81,000	80,000	79,000	78,000
Minimum	16,000§	.....	72,000	40,000§	.....	77,000	40,000§	.....	77,000	73,000	80,000	80,000	78,000	75,000	73,000	73,000	72,000	71,000	69,000
Tensile Yield Strength (Offset = 0.2%), psi.																			
Typical	14,000	20,000	67,000	15,000	22,000	72,000	19,000	23,000	76,000	80,000	80,000	77,000	74,000	72,000	71,000	71,000	70,000	70,000	69,000
Minimum	20,000	.....	62,000	21,000§	.....	66,000	.....	.....	66,000	70,000	72,000	70,000	70,000	64,000	62,000	61,000	59,000	60,000	58,000
Elongation in 2 in., %																			
Typical	17	20	11	17	20	11	19	.....	13	10	10	10	10	12	11	11	10	10	9
Minimum	10	.....	8	10	.....	8	10	.....	7	7	7	7	6	9	8	7	6	4	3
Compressive Yield Strength (Offset = 0.2%), psi.	15,000	.....	68,000	16,000	.....	74,000	.....	.....	72,000	80,000	80,000	.....	.....	76,000	75,000	75,000	74,000	74,000	73,000
Brinell Hardness**	.....	.....	.....	60	.....	150	60	.....	150	150	150	.....	.....	150	150	150	150	150	150
Shearing Strength, psi.	22,000	.....	46,000	22,000	.....	49,000	22,000	.....	50,000	47,000	47,000	.....	.....	49,000	49,000	49,000	48,000	48,000	47,000
Bearing Strength, psi.																			
Edge Distance, 1.5D	.....	.....	114,000	.....	.....	123,000	.....	.....	114,000	106,000	.....	.....	.....	.....	.....	.....	.....	.....	.....
Edge Distance, 2D	.....	.....	144,000	.....	.....	156,000	.....	.....	141,000	141,000	.....	.....	.....	.....	.....	.....	.....	.....	.....
Bearing Yield Strength, psi.																			
Edge Distance, 1.5D	.....	.....	95,000	.....	.....	102,000	.....	.....	104,000	88,000	.....	.....	.....	.....	.....	.....	.....	.....	.....
Edge Distance, 2D	.....	.....	109,000	.....	.....	117,000	.....	.....	112,000	112,000	.....	.....	.....	.....	.....	.....	.....	.....	.....

Average value for modulus of elasticity of 75S in tension and compression is 10,400,000 psi. For Alclad 75S Sheet and Plate the primary and secondary moduli are 10,400,000 and 9,600,000 psi.
* Values shown are for thicknesses of 0.040 to 0.499 in. § Maximum. † Effects of natural aging are shown in Fig. 1. †† Longitudinal properties of hand forged material heat treated in sections 3 in. or less in diameter or thickness.
** 500 Kg–10mm. diam. ball.

Tests by Hill and Barker at Aluminum Research Laboratories on Alclad 75S-T6 sheet with various patterns of round holes in tensile specimens showed that this material was actually better in this respect than 24S-T3 sheet.

Thus, for a given pattern of holes in a given size of tension specimen, the breaking strength of the Alclad 75S-T6 sheet was a higher percentage of the expected breaking strength based on the tensile strength of the material than was the case for the 24S-T3 sheet.

▶ **Directional Properties**—A word of caution is in order in connection with the problem of static design of parts where the direction of the principal stresses is in the weakest direction of the material. This problem is not peculiar to 75S-T6, but is likely to be somewhat more critical because of the high design stresses used and because of the relatively low elongation encountered in some 75S-T6 products in the weakest direction.

To evaluate the following remarks it is necessary first to understand clearly that there are no commercial structural wrought materials truly homogeneous and isotropic.

All commercial structural wrought metals display directional properties to some degree, with the maximum strength usually being in the direction of the principal working of the metal and the weakest direction being in one of the directions at right angles to this. In some products the weakest direction is of no importance to the designer. For example, in the case of sheet the weakest direction is through the thickness.

As designers make use of larger and larger pieces of metal, however, the weakest direction of the material becomes increasingly important. If a fitting is cut from the large end of a stepped extruded shape or from a hand forging, there may be places in the part where relatively high stresses exist in the weakest direction. The stresses which may be allowed in this direction must be held to safe limits based on the properties that have been determined for this direction.

It is further important that such parts be carefully analyzed for secondary stresses of a type which can ordinarily be overlooked in design but which may assume considerable importance if they exist in the weakest direction.

▶ **"Explosive" Failure**—Some designers have been alarmed by the so-called explosive type of failures encountered in static tests of 75S-T6 structural units, and have wondered if such failures should cause them to modify their static design procedures.

It should be remembered that the explosive type failure is a natural consequence of the fact that 75S-T6 has an unusually high yield strength with a relatively low elongation. When a 75S-T6 test piece is stressed in a testing machine, a great deal of energy is stored up in the specimen because of its unusually large elastic stress range. Hence, when a fracture starts it is quite likely that it will progress very rapidly and that the sudden release of energy will be accompanied by considerable violent activity and secondary effects which might have been avoided to a considerable degree had the specimen been built of lower strength material.

In general, it is believed that the explosive type of failure does not in itself indicate any mysterious characteristics of the material which need influence the design of 75S structures for static loads.

▶ **Impact Considered**—Some attention should be given to the design of parts subjected to impact or shock loading. Such parts are often designed for the static load increased by some amount intended to take care of the impact effects. This procedure does not cause any difficulty in the case of 75S-T6 as long as the stresses set up are all within the elastic range.

If, however, the stresses exceed the elastic range, it is well to remember that the total energy-absorbing capacity of a part made from 75S-T6 is likely to be less than that of the same part made from a lower strength, more ductile material.

Furthermore, the extra energy stored in the 75S-T6 part because of its greater elastic range is likely also to lead to a violent fracturing of the material at failure, all of which may be disconcerting to the designer who has not thought through the problem rather carefully.

To get the highest ultimate shock resistance in 75S-T6 structural parts, it is necessary, as in the case of any other material to design the part carefully so that if plastic deformations occur they will be distributed as well as possible throughout a considerable portion of the metal involved, rather than concentrated at certain points where there are abrupt changes in section.

▶ **Repeated Loads**—The problem of designing aircraft structures to withstand repeated loads is, of course, not much different for 75S-T6 than it would be for any other metal except that the use of higher design stresses makes the problem somewhat more critical, since the increase in design stresses is not accompanied by a corresponding increase in the fatigue resistance of the material. Here again, the alert designer will not assume that because he previously has not encountered fatigue difficulties in aircraft structural design it is safe to ignore fatigue for the new material.

Designing for a given life in fatigue is, of course, not as definite as the problem of designing for a given static strength. This is true even in older materials of construction. Nevertheless, much can be done to improve fatigue life of structures or at least to avoid any unduly short fatigue life. Purpose of the following discussion is to comment on some of the items which have a bearing on this problem.

▶ **Stresses Considered**—It is generally understood by structural designers that the stresses which are calculated for a structure by conventional methods are only nominal values and that on these are superimposed various stress concentrations which may raise the actual stresses locally to amounts considerably higher than the nominal calculated values.

At the edge of every rivet hole, for example, stresses are almost certain to be higher than the nominal calculated values. These peak stresses are of little consequence in static design because, as already pointed out above, most of our construction materials have sufficient ductility to permit plastic deformations which will blunt these peak stresses and level out the stress distribution long before the material

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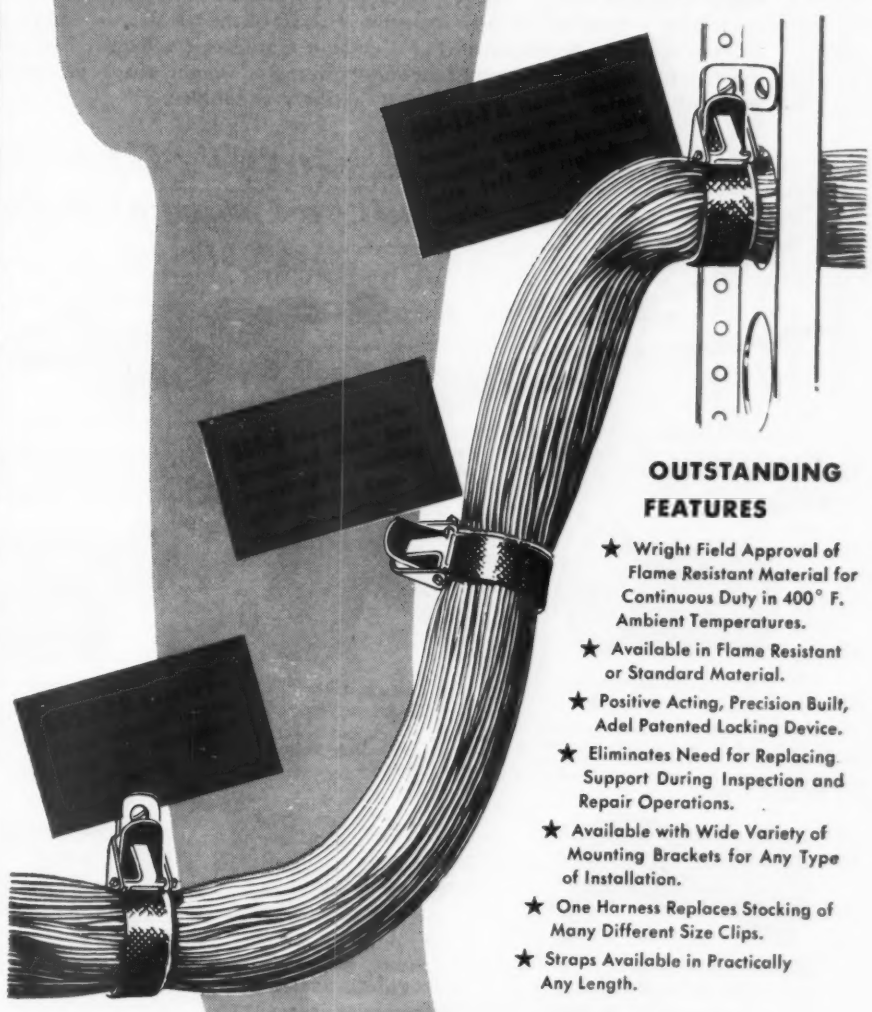

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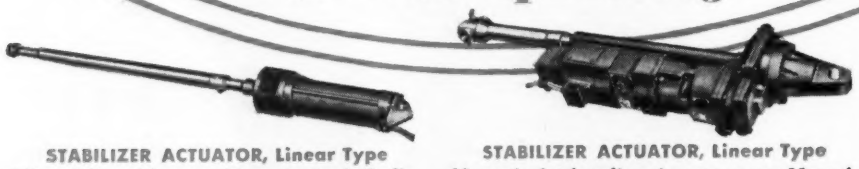

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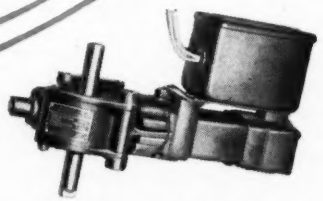

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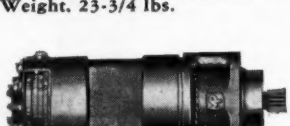

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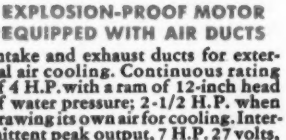

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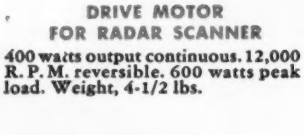

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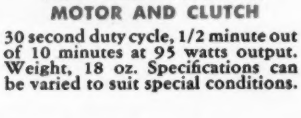

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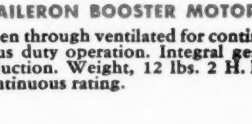

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reaches the point of actual fracture.

Under repeated load conditions, however, the peak stresses are the controlling factors in the final failure of the part. Fatigue failures almost always start in some region where there is a localized stress concentration considerably higher than the nominal calculated stress, and it is the repetition of this high stress in the localized area which causes a crack to start.

► **Fracture Action**—Once the fatigue fracture has started in some area of localized high stress it progresses across the section rather rapidly because the bottom of the fatigue crack is a very sharp notch where the stress concentrations may be even greater than the one which caused the crack to start.

Occasionally, of course, a situation arises in which the spreading of the fatigue crack relieves the load on the part and causes the load to be transferred to some nearby stiffer part of the structure, thus tending to slow down the progress of the fatigue fracture or even causing it to be self-stopping.

More normal case, however, is that in which the progress of the fatigue fracture increases the stress so that complete rupture occurs a short time after the crack is initiated.

► **Fatigue Analysis**—It is clear that the problem of designing for fatigue is mainly one of recognizing those features of the structrue which are likely to act as stress raisers, to estimate the degree of stress concentration existing at those stress raisers which cannot be eliminated or improved, and to estimate the fatigue life of the material under the stress variation existing at the most severe stress raisers.

If the fatigue life so estimated represents an ample life for the structure, then the fatigue analysis is a relatively simple matter and does not require any great amount of attention.

If, however, the fatigue life so estimated is considered too low, the designer is obligated to go into the matter more fully and to modify the design in some manner which will insure the desired life expectancy.

It is not intended to outline the details of how to make a fatigue analysis. Several appended references may be of interest along this line. A word of caution should be given, however, against the blind use of stress concentration factors determined by conventional methods of experimental or theoretical analysis. It should always be remembered that when the peak stress exceeds the elastic range of the material the stress concentration factor becomes less than the theoretical value owing to the local plastic deformation which occurs.

Unless this important fact is kept in mind, it is very likely that the predicted fatigue life will be considerably less than the actual fatigue life.

► **Stress Raisers**—All structures contain stress raisers. Some of these, such as gradual or abrupt changes of section, filleted or unfilleted reentrant corners, lightening holes and other discontinuities are deliberately introduced by the designer as a necessary consequence of the proportioning of the component parts of the assembly.

Other stress raisers such as rivet and bolt holes, welds, etc., are introduced as a necessary consequence of connecting the component parts.

Table II—Typical Tensile Properties of 75S-O Products at Various Temperatures

Temp. F.	Tensile Strength, Psi.	Yield Strength,* Psi.	Elongation in 4D, %
Sheet, Plate, Wire, Rod and Bar:			
−320	50,000	19,000	20
−112	37,000	16,000	18
0	35,000	15,000	16
75	34,000	15,000	16
212	31,000	15,000	22
300	24,000	14,000	35
400	14,000	12,000	60
500	11,000	8,500	65
600	8,500	6,500	80
700	6,500	4,500	65
Alclad Sheet and Plate:			
−320	47,000	18,000	....
−112	35,000	15,000	....
0	33,000	14,000	....
75	32,000	14,000	....
212	29,000	14,000	....
300	23,000	13,000	....
400	13,000	11,000	....
500	10,000	8,000	....
600	8,000	6,000	....
700	6,000	4,500	....

* Offset equals 0.2 percent.

Table III—Typical Tensile Properties of 75S-T6 Products at Various Temperatures

Temp. F.	Tensile Strength, psi. After Holding at Testing Temperature 1/2 Hr.	10,000 Hr.	Yield Strength,* psi. After Holding at Testing Temperature 1/2 Hr.	10,000 Hr.	Elongation in 4D, % After Holding at Testing Temperature 1/2 Hr.	10,000 Hr.
Sheet, Plate (Max. 2 In.), Wire, Rod and Bar						
−320	98,000	.....	85,000	.....	12	....
−112	86,000	.....	75,000	.....	11	....
0	83,000	.....	73,000	.....	11	....
75	82,000	82,000	72,000	72,000	11	11
212	72,000	65,000	64,000	60,000	15	15
300	57,000	25,000	51,000	21,000	20	30
400	38,000	14,000	34,000	12,000	20	60
500	16,000	11,000	14,000	8,500	35	65
600	9,500	8,500	7,000	6,500	55	80
700	6,500	6,500	5,000	4,500	60	65
Alclad Sheet and Plate (Max. 2 In.):						
−320	91,000	.....	79,000	.....	....	....
−112	80,000	.....	70,000	.....	....	....
0	77,000	.....	68,000	.....	....	....
75	76,000	76,000	67,000	67,000	....	....
212	67,000	61,000	59,000	56,000	....	....
300	53,000	23,000	47,000	19,000	....	....
400	35,000	13,000	32,000	11,000	....	....
500	15,000	10,000	13,000	8,000	....	....
600	8,500	8,000	6,500	6,000	....	....
700	6,000	6,000	4,500	4,500	....	....
Extrusions (Max. Thickness 4 In.; Max. Cross-Section 20 Sq. In.):						
−320	112,000	.....	104,000	.....	7	....
−112	93,000	.....	85,000	.....	8	....
0	91,000	.....	82,000	.....	9	....
75	88,000	88,000	80,000	80,000	10	10
212	77,000	68,000	70,000	62,000	15	16
300	63,000	27,000	56,000	21,000	22	33
400	40,000	16,000	34,000	12,000	22	55
500	15,000	11,000	13,000	8,500	45	60
600	9,500	8,500	7,000	6,500	65	70
700	6,500	6,500	5,000	4,500	75	75

* Offset equals 0.2 percent.

Still others are introduced as a result of fabricating the structure. Under this heading might be included rough machined surfaces, scratches, nicks, dents, and misalignment of parts.

Often overlooked are the stress raisers which may be introduced after the structure is in service, some of which are the same as those introduced in the fabrication process (scratches nicks, etc.), but less readily recognized are spots that are roughened by corrosion or by abrasion. In the last category come the roughening from fretting on faying surfaces that rub together only a very minute amount.

Obviously all stress raisers are not of equal importance in the life of a structure and with some experience and study the designer will learn which are important and which can be safely ignored.

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The experienced designer will search out quickly the controlling stress raisers or combination of stress raisers and will concentrate his attention on these parts.

He quickly learns that it is not profitable to worry unduly about minor scratches and surface blemishes in a member which contains rivet holes and other stress raisers much more serious from the fatigue viewpoint.

In studying repeated stresses it should be remembered that the maximum loadings assumed in ordinary static design are much more severe than those which occur regularly in service. An intelligent study of fatigue action in any structure usually involves a separate analysis of the stresses using loading conditions quite different from the maximum loadings assumed in the static design.

The loading of principal interest from the standpoint of fatigue is usually a mean load representing level-flight upon which is super-imposed a variable loading (plus and minus) representing some gust condition which might be encountered for a significant number of times during the life of the airplane.

▶ **Points on Fatigue**—Since most aircraft structures are riveted, some general observations based on fatigue investigations of riveted structural elements at Aluminum Research Laboratories may be helpful:

A hole well-filled with a rivet causes less reduction of the fatigue strength of a structure than an open hole.

Reduction of the fatigue strength of a structure is greater for a rivet carrying stress than for a stitch rivet.

Lap joints reduce the fatigue strength of a structure more than symmetrical joints such as butt joints with double straps. This greater effect seems to be associated with the greater flexing which occurs in the lap joint. Any stiffening of the lap joint to prevent undue flexing under repeated loads tends to improve the fatigue characteristics of the joint.

▶ **Estimated Life**—In designing 75S-T6 structures for repeated loads, the designer will soon discover that most typical structural elements designed of this material show a shorter estimated life than those designed in 24S-T4 for the same static conditions.

There are two reasons for this. One is that the 75S-T6 material is designed to operate at higher nominal calculated stresses. The other is that a given geometrical configuration is usually a more severe stress raiser in 75S-T6 owing partly to the greater elastic range of the material and the consequent lesser tendency for the peak stresses to be blunted by plastic action.

Predictions based on this reasoning are borne out fully by actual fatigue tests of fabricated structural parts. Many times it is found that even when the two members compared are of identical size, the 75S-T6 member will have shorter life than the 24S-T4 member.

A good example of this is found in NACA Restricted Bulletin 5F11 "Comparative Fatigue Tests of Riveted Joints of Alclad 24S-T, Alclad 24S-T81, Alclad 24S-RT, Alclad 24S-T86, and Alclad 75S-T Sheet," by H. N. Hill and R. L. Moore, August, 1945. Other examples will be found

(Continued on Page 33)

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"The unseen passenger" is a common occurrence on most transport planes. With due consideration to the take-off weight it is not always possible to carry the full complement of passengers, although empty seats are available in the plane.

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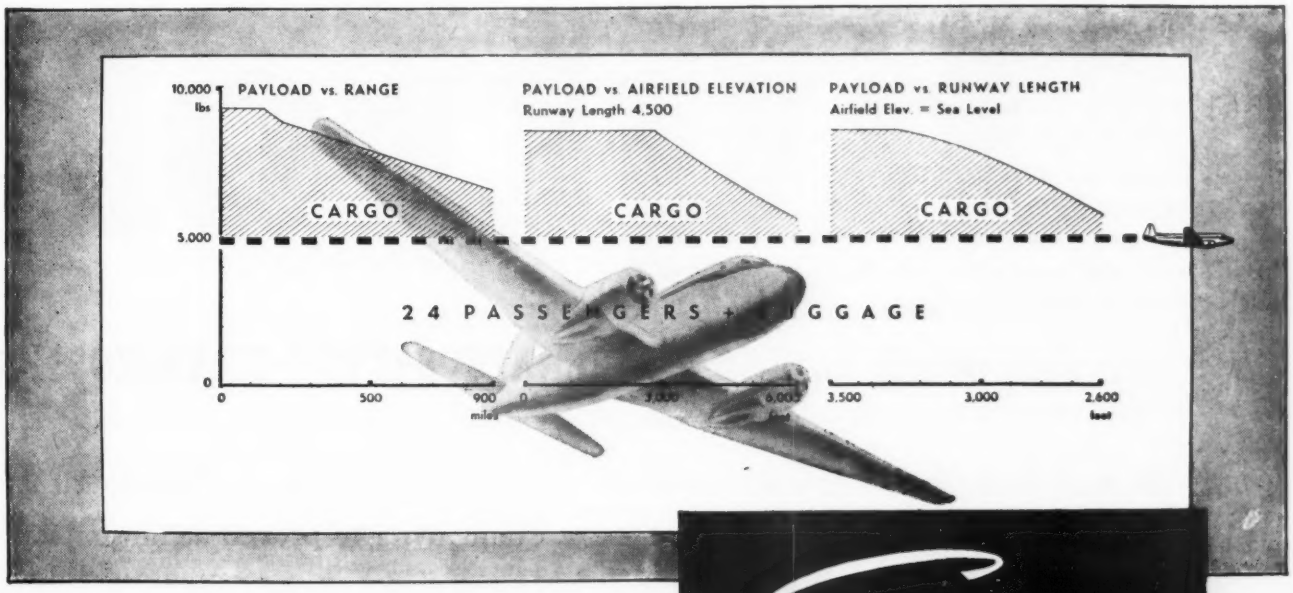

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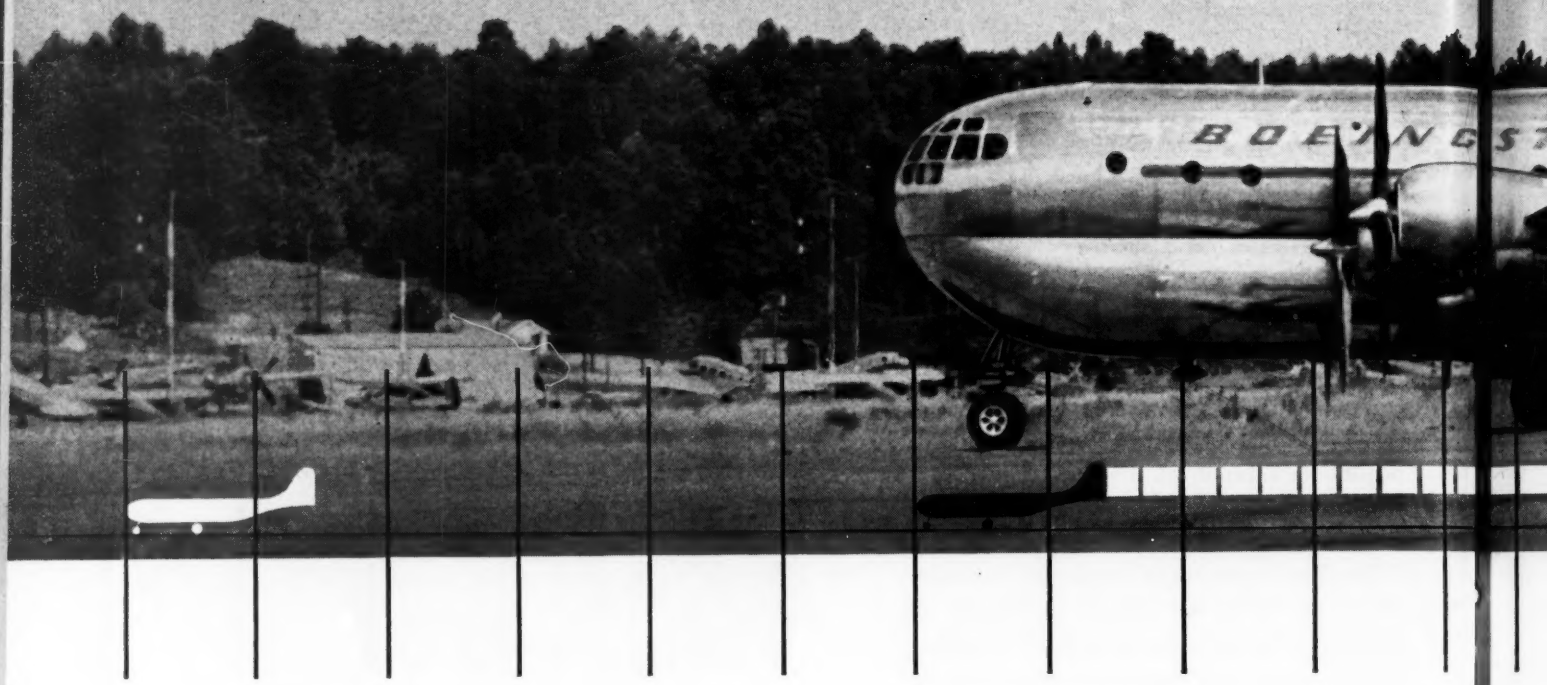

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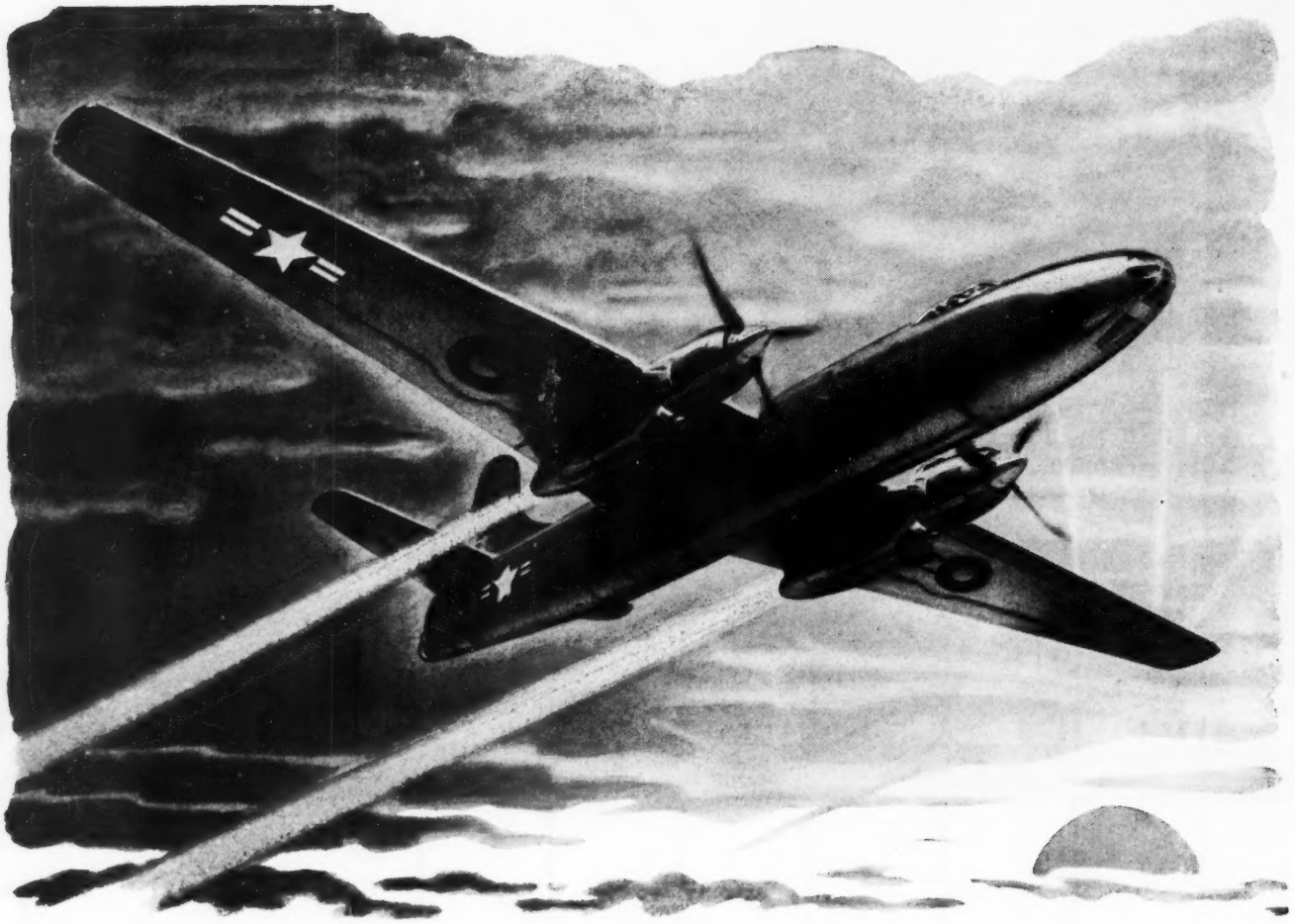

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Table IV

Modulus of Elasticity

Alloy	Average Modulus at 75 F., psi.
2S	10,000,000
3S	10,000,000
14S	10,600,000
24S	10,600,000
53S	10,000,000
61S	10,000,000
75S	10,400,000

Modulus at Various Temperatures

Temperature, F.	Approximate Value of Modulus in Terms of Modulus at 75 F. 75S	24S & 14S
−320	112%	112%
−112	105	105
− 18	102	102
75	100	100
212	95	98
300	88	94
400	80	88
500	68	81
600	50	73

Table V—Typical Tensile Properties of 75S-T6 Products at Room Temperature After Heating

Temp. F.	Tensile Strength, psi. After Heating 1/2 Hr.	10,000 Hr.	Yield Strength,* psi. After Heating 1/2 Hr.	10,000 Hr.	Elongation in 4D, % After Heating 1/2 Hr.	10,000 Hr.
Sheet, Plate (Max. 2 In.), Wire, Rod and Bar:						
75	82,000	82,000	72,000	72,000	11	11
212	82,000	78,000	72,000	66,000	11	11
300	79,000	40,000	69,000	24,000	11	11
400	70,000	31,000	58,000	15,000	11	15
500	47,000	.....	29,000	.....	12	....
600	40,000	.....	18,000	.....	15	....
Alclad Sheet and Plate (Max. 2 In.):						
75	76,000	76,000	67,000	67,000	....	....
212	76,000	72,000	67,000	62,000	....	....
300	74,000	37,000	64,000	22,000	....	....
400	65,000	28,000	54,000	14,000	....	....
500	43,000	.....	27,000	.....	....	....
600	37,000	.....	17,000	.....	....	....
Extrusions (Max. Thickness 4 In.; Max. Cross-Section 20 Sq. In.):						
75	88,000	88,000	80,000	80,000	10	10
212	88,000	81,000	80,000	68,000	10	11
300	85,000	40,000	75,000	24,000	11	15
400	72,000	31,000	62,000	15,000	11	18
500	49,000	.....	33,000	.....	14	....
600	40,000	.....	21,000	.....	16	....

* Offset equals 0.2 percent.

Table VI—Rotating-Beam Fatigue Strengths of Smooth, Longitudinal Specimens

Product	Alloy and Temper	Fatigue Strength, psi. 10^5 Cycles	10^6 Cycles	10^7 Cycles	10^8 Cycles	5×10^8 Cycles
Rod	75S–T6	48,000	36,000	29,500	26,000	26,000
	24S–T4	43,000	35,000	27,000	21,000	19,500
	14S–T4	41,000	33,500	27,000	21,500	19,500
	14S–T6	40,000	31,500	24,500	20,500	18,000
Plate	75S–T6	43,500	33,500	26,500	23,500	22,500
	24S–T4	39,000	32,000	25,500	20,000	17,500
	14S–T6	37,500	30,500	24,500	19,500	18,000
Forgings	75S–T6	.....	35,000	30,000	27,500	26,000
	14S–T4	40,500	31,500	26,500	22,500	20,500
	14S–T6	40,000	32,000	25,500	21,000	19,000
Extrusions	75S–T6	43,000	31,000	25,500	23,500	22,500
	24S–T4	.....	36,000	27,500	21,500	20,500
	14S–T4	44,500	35,500	28,500	23,000	20,000
	14S–T6	41,500	32,000	25,500	20,500	18,000

Values determined using 0.3-in. diam. specimens in R. R. Moore type fatigue machines.

in references given at the end of this paper.

▶ **Improving Stress Raisers**—When analysis shows that fatigue is likely to be a controlling factor in design, every effort should be made to decrease the severity of the controlling stress raisers as the most desirable method for improving the fatigue life.

The more obvious methods of accomplishing this are, of course, to use generous fillets in reentrant corners, employ grad-

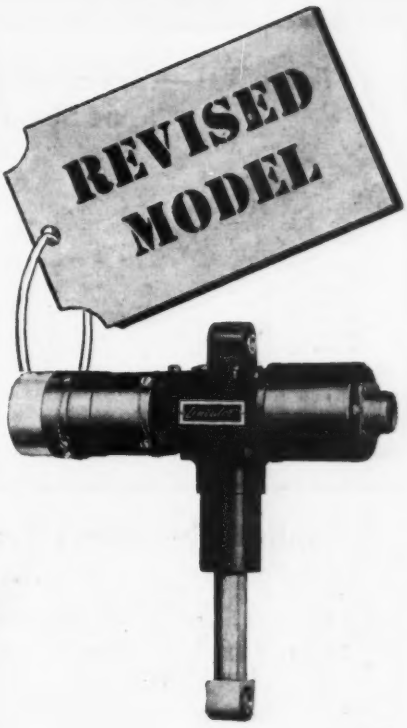

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Table VII—Reversed Flexure Fatigue Strengths of Sheet Specimens

Alloy and Temper	Fatigue Strength (Reversed Stress), psi. at Indicated Number of Cycles 100,000	1,000,000	10,000,000	100,000,000	500,000,000
75S–T6	.....	25,000	21,500	21,000	20,500
24S–T3	34,000	27,000	21,000	18,500	17,500
24S–T36	36,000	27,000	21,000	19,000	18,000
Alclad 75S–T6	29,000	20,000	15,000	13,000	12,500
Alclad 24S–T3	32,000	20,000	15,000	13,000	12,500
Alclad 24S–T36	32,000	20,500	16,000	13,500	13,500
Alclad 24S–T81	27,500	17,000	14,500	13,500	13,500
Alclad 24S–T86	32,000	19,000	14,500	13,500	13,000
Alclad 14S–T3	31,000	20,000	17,000	15,500	15,000
Alclad 14S–T6	31,000	20,000	17,000	15,500	15,000

Values determined using specimens of 0.064-in. sheet with as-rolled surfaces, subjected to reversed bending stresses in ARL sheet fatigue machines.

Table VIII—Direct Tension-Compression Fatigue Strengths

Alloy and Temper	Mean (Steady) Stress, psi.	Reversed (Alternating) Stress, psi., at Indicated Number of Cycles 100,000	1,000,000	10,000,000	100,000,000	500,000,000
75S–T6	−10,000	±38,000	±31,000	±25,000	±21,000	±20,000
	− 5,000	±37,000	±30,000	±23,000	±20,000	±19,000
	0	±36,000	±29,000	±22,000	±19,000	±18,000
	+ 5,000	±34,000	±27,000	±21,000	±17,000	±16,000
	+10,000	±33,000	±26,000	±19,000	±16,000	±15,000
	+15,000	±31,000	±24,000	±17,000	±14,000	±13,000
	+20,000	±29,000	±22,000	±16,000	±13,000	±12,000
24S–T4 14S–T6	−10,000	±33,000	±26,000	±21,000	±18,000	±16,000
	− 5,000	±33,000	±26,000	±21,000	±17,000	±16,000
	0	±32,000	±26,000	±20,000	±17,000	±15,000
	+ 5,000	±32,000	±25,000	±20,000	±16,000	±15,000
	+10,000	±31,000	±24,000	±19,000	±16,000	±14,000
	+15,000	±29,000	±23,000	±18,000	±15,000	±14,000
	+20,000	±27,000	±22,000	±17,000	±14,000	±13,000
	+25,000	±25,000	±21,000	±16,000	±13,000	±12,000

Values determined by testing 0.2-in. diam. specimens in ARL Direct-Stress fatigue machines and represent uniformly distributed stresses which such specimens will withstand under repeated axial loads.
Stresses considered algebraically: Plus (+) means tension, Minus (−) means compression.

Table IX—Torsional Shear Fatigue Strengths

Alloy and Temper	Mean (Steady) Stress, psi.	Reversed (Alternating) Stress, psi., at Indicated Number of Cycles 100,000	1,000,000	10,000,000	100,000,000	500,000,000
75S–T6	0	±33,000	±23,000	±19,000	±16,000	±14,000
	+ 5,000	±31,000	±22,000	±18,000	±15,000	±13,000
	+10,000	±30,000	±21,000	±17,000	±14,000	±13,000
	+15,000	±28,000	±20,000	±16,000	±14,000	±12,000
	+20,000	±26,000	±18,000	±15,000	±13,000	±11,000
	+25,000	.....	±17,000	±14,000	±12,000	±11,000
	+30,000	.....	±16,000	±13,000	±11,000	±10,000
24S–T4 14S–T6	0	±27,000	±21,000	±16,000	±11,000	±10,000
	+ 5,000	±26,000	±20,000	±15,000	±11,000	±10,000
	+10,000	±25,000	±19,000	±14,000	±11,000	±10,000
	+15,000	±23,000	±18,000	±14,000	±11,000	± 9,000
	+20,000	.....	±17,000	±13,000	±10,000	± 9,000
	+25,000	.....	±16,000	±12,000	±10,000	± 9,000
	+30,000	.....	.....	±11,000	± 9,000	± 9,000

Values determined by testing 0.330-in. diam. specimens in ARL Torsion Fatigue Machine.

ual rather than abrupt changes of section, round sharp edges and corners, and eliminate situations which lead to overlapping effects of one stress raiser on another.

When a designer has done his best on making such improvements, there still will remain certain stress raisers which cannot easily be further improved simply by changing the geometry of the part. Further improvement in fatigue can be obtained in such cases, if necessary, by some operation which will leave the part with a residual or superimposed stress pattern conducive to long life.

It is well known, for example, that the fatigue life of a bolt in tension is improved by drawing the bold up very tightly, so that the range of stress variation caused by repeated loads is greatly reduced.

It has also been demonstrated that cold working the surface of a critical region by rolling or shot peening, so as to produce a residual compressive stress on the surface of the part, is beneficial to the fatigue life.

These methods are of more importance to the machine designer than to the structural designer but are worthwhile keeping in mind when unusual fatigue problems are encountered in structures.

When fretting is a controlling factor in fatigue life, conditions can sometimes be improved by suitable surface treatment or by the introduction of intermediate layers of some material which will minimize the harmful effects of the rubbing action.

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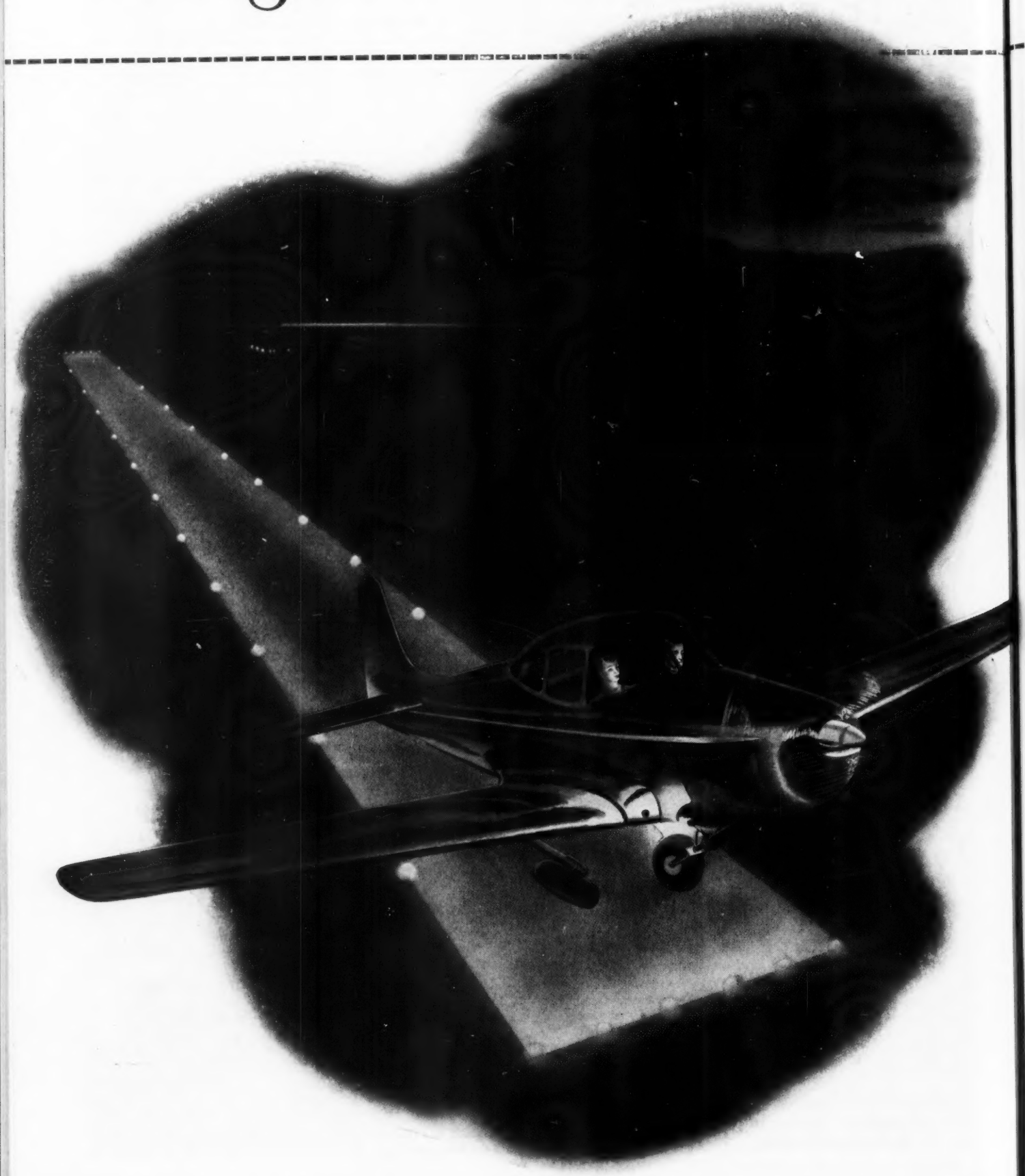

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Table X—Fatigue Strengths at Elevated Temperatures

Alloy and Temper	Testing Temp., F.	Fatigue Strength (Reversed Stress), psi., at Indicated Number of Cycles 100,000	1,000,000	10,000,000	100,000,000	500,000,000
75S-T6	75	45,000	35,000	27,000	22,000	21,000
	300	18,000	15,000	13,000	12,000	12,000
	400	13,500	11,000	9,500	8,500	8,500
	500	11,000	9,000	7,500	7,000	7,000
24S-T4	75	40,000	32,000	25,000	20,000	18,000
	300	24,000	20,000	17,500	15,000	14,000
	400	20,000	16,000	12,500	10,000	9,000
	500	14,000	10,500	8,500	7,000	6,000
14S-T6	75	40,000	32,000	25,000	20,000	18,000
	300	22,500	18,000	15,000	13,000	12,000
	400	15,000	12,000	10,000	8,500	8,000
	500	10,000	8,500	7,000	5,500	5,000

Values determined using polished smooth specimens 0.4-in. diam. subjected to reversed bending stresses in ARL Elevated Temperature Fatigue Machines. All specimens had been subjected to prolonged heating at the testing temperature before testing.

Table XI—Endurance Limits for Sharply Notched Rotating-Beam Specimens

Alloy and Temper	Notch Endurance Limit, psi. Rod	Plate	Forgings	Extrusions
75S-T6	8,500	6,000†	10,000*	6,500
24S-T4	11,000	13,000	Not Produced	8,500
14S-T4	12,000	Not Tested	10,000	8,000
14S-T6	8,500	10,500*	6,500†	7,000

* Seems high by comparison with tests of other products.
† Seems low by comparison with tests of other products.
Values determined using specimens containing single 60 deg. sharp V-notch 0.075-in. deep with root diameter of 0.330 in. and radius about 0.0002 in. at root.

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31. Axial Fatigue Tests at Zero Mean Stress of 24S-T and 75S-T Aluminum Alloy Strips With a Central Circular Hole, by W. C. Brueggeman and M. Mayer, Jr. NACA Technical Note No. 1611, August 1948.

Tough Wire Recorder For Guided Missiles

Especially designed for installation in guided missiles, a rugged new tape recorder has been developed for the Navy Bureau of Ordnance by the research department of United Aircraft Corp., East Hartford, Conn., and the Armour Research Foundation of the Illinois Institute of Technology.

► **Survival Featured**—Mounted in the nose of the missile, the device records 200 pieces of information simultaneously and continuously on a 6-in. wide steel tape. So that it will remain intact when it hits the ground, the tape is led into an armored container that withstands the exhausted rocket's crashing.

In one test with a guided missile, the armored container with the tape was the only intact piece of equipment in the crater dug by the rocket. The cylinder also has been dropped without damage onto Connecticut stone quarries from a United Aircraft-operated helicopter.

The recordings cover up to 110 seconds of the missile's flight and takedown such factors as air pressure, temperature, speed and gyro positions through electrical signals from scores of instruments. Once recovered after the crash, the 150-ft. long strip of steel tape is played back through a transcriber and the information is then plotted on charts.

► **Advantages**—The compact recorder weighs only 46 lb., is 10⅜ in. long and 8½ in. in diameter. The device promises to gather information that has been inaccessible with recorders in use up to this time. Paper tape recordings and automatic photographs can be too easily burned, torn or exposed to light. The method of sending automatic radio signals from the missile to the ground requires elaborate ground and air equipment and difficulties often are encountered in transmission and reception of a comparitively limited number of messages.

The flying recorder was developed as part of the guided missile program under Project Meteor, of the Navy's Bureau of Ordnance.

Fire-Resistant Fluid Used in Super DC-3

First commercial aircraft specially equipped to use a fire-resistant hydraulic fluid is the Douglas Super DC-3.

The Super DC-3 incorporates a hydraulic system designed to use Skydrol—a new form of fluid (AVIATION WEEK, July 18) developed jointly by Douglas Aircraft Co., Santa Monica, Calif., and Monsanto Chemical Co., St. Louis, Mo.

► **Few Changes Necessary**—Use of the new product, which has an ester base, required only a change in the Super's hydraulic system's seals and packings. Skydrol severely attacks all leather, buna and Neoprene seals and packings, etc., normally used with standard fluids AN-VVO-366a and AC-3580. These were replaced by packings made of Nylon and other synthetic materials which reportedly are not affected by Skydrol's ester base.

According to Douglas engineers, Skydrol does not have as high nonflammable characteristics as several fire-resistant fluids recently developed, but makes up for this by having much better lubricating qualities. The product is said to be non-toxic and to have no effect on metals.

Develop Expendable Airline Oxygen Mask

Development of a constant-flow oxygen mask for airline passengers, which will cost about 25 cents and can be thrown away after use, has been announced by the Air Materiel Command, Wright Field.

The expendable mask, which will remain effective for 4-5 hours at altitudes up to 25,000 ft., is an answer to requests by the Military Air Transport Service and commercial airlines for a cheap, but temporarily efficient means of supplying oxygen to passengers when planes are forced above their normal flight levels.

Developed by Wright Field's Aero Medical Laboratory, the University of Washington and the H. L. Burns Co., Portland, Ore., the new mask still is being perfected before being released for production.

▶ **Design**—The device consists essentially of a porous paper face piece, a bellows made from .01-in. thick Pliofilm, and a plastic tubing which connects to the plane's oxygen supply.

Radio Noise Project

An investigation to determine the causes and possibly eliminate the noises and interferences in aircraft radios and electronic devices has been started by the Curtiss-Wright Corp., Columbus, Ohio, under contract with the Air Force.

C-W engineers reportedly plan to approach the problem in an entirely new way by ignoring use of conventional filters and attempting to develop some other method of eliminating noise.

Preliminary research will be conducted in the company's copper-lined laboratory. Any new developments will be tested in an Air Force B-17 bomber. The project, which may aid in future design of radio and electronic equipment, is scheduled to extend over more than a year.

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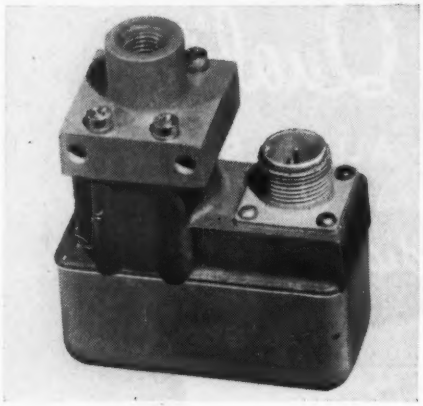


Pressure Switches

Improved aircraft pressure switches made by **Saval, Inc.**, 1915 E. 51 Street, Los Angeles 11, Calif., feature smaller size, reduced weight, and provision for external adjustment. It is stated that switches can be operated at wide range of "cut-in" and "cut-out" pressures from 100-3000 psi., and external adjustment feature provides for easy manual regulation in the field for intermediate ranges of 500 psi. Units operate on hydraulic oil, and can be made to work on fuel, oil, air, and non-corrosive types of freon. Aircraft applications include automatic operation of warning lights, operation of dump valves, by-pass valves, and auto control of hydraulic pumps. Switches can be modified to handle pressures to 5000 psi., and to operate with corrosive fluids.

Voltage Checker

Capable of handling aircraft electrical checks is Boes Dayton V.R.C. model 88 voltage regulater check made by **Testing Instruments, Inc.**, 120 W. Second Street, Dayton 2, Ohio. Standard ammeter ranges are given as 30-60 amp., and a separate pair of connections is provided so that ammeter shunts of any value up to 1200 amp. can be connected and read accurately on the scale.

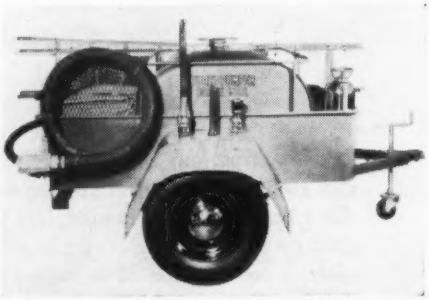
Conveyor Aid

For changing direction of material flow on conveyors, "Y" switch, offered by **Sage Equipment Co.**, 30 Essex St., Buffalo, N. Y., directs parts from single conveyor into either one of two lines converging at 45 deg.

Material flow is diverted to right or left conveyor depending on position of removable center section which can be changed to guide parts in either direction. Center section is simply flipped to one side and locked in place by operator.

For conveyors converging into a single line at 90 deg., company provides special 45-deg. sections which can be added to "Y" switch.

Unit is available with wheels and rollers for use with 12-, 14-, 18-, and 24-in.-wide conveyors.



Fire Fighting Aid

Compact (6 ft. x 9 ft.) Porto-Pumper fire fighting trailer has been developed by **Porto-Pump, Inc.**, Detroit, Mich. Unit can be attached to any vehicle, and is equipped with a demountable Porto-Pump rotary positive displacement type rubber gear pump, powered by a 4-cycle gasoline engine; supply hose; aluminum extension ladder; 200 ft. of fire hose; fire axe and hand extinguisher; straight stream nozzle; combination fog and straight stream nozzle; and a 200-gal. water tank supply. Optional equipment includes foam producing nozzles.

Reshapes Electrodes

Air powered dresser, Model 7165, made by the **Aro Equipment Corp.**, Bryan, Ohio, is lightweight tool designed for reshaping copper electrodes on spotwelding machines without removing tips.

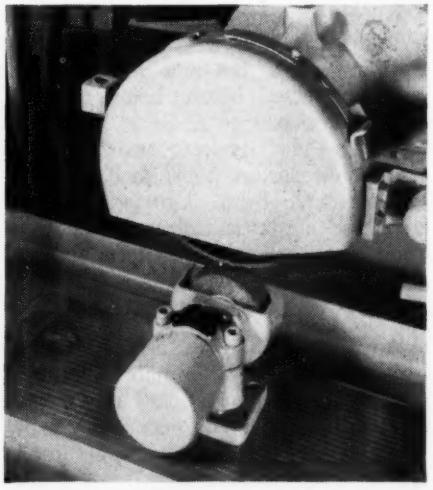
With 1200-rpm. cutting speed, device is stated to permit dressing electrodes five times faster than is possible with other methods.

Tool weighs 3½ lb. and can be supplied with cutting blades for No. 1 and 2 dome-type or No. 1 and 2 pointed electrodes.

Unit has ¾-in. angle height, 10⅜-in. overall length and ¼-in. pipe air inlet. Company claims users of multi-point welding machines will be benefited most by new tool.

Whiteprinter

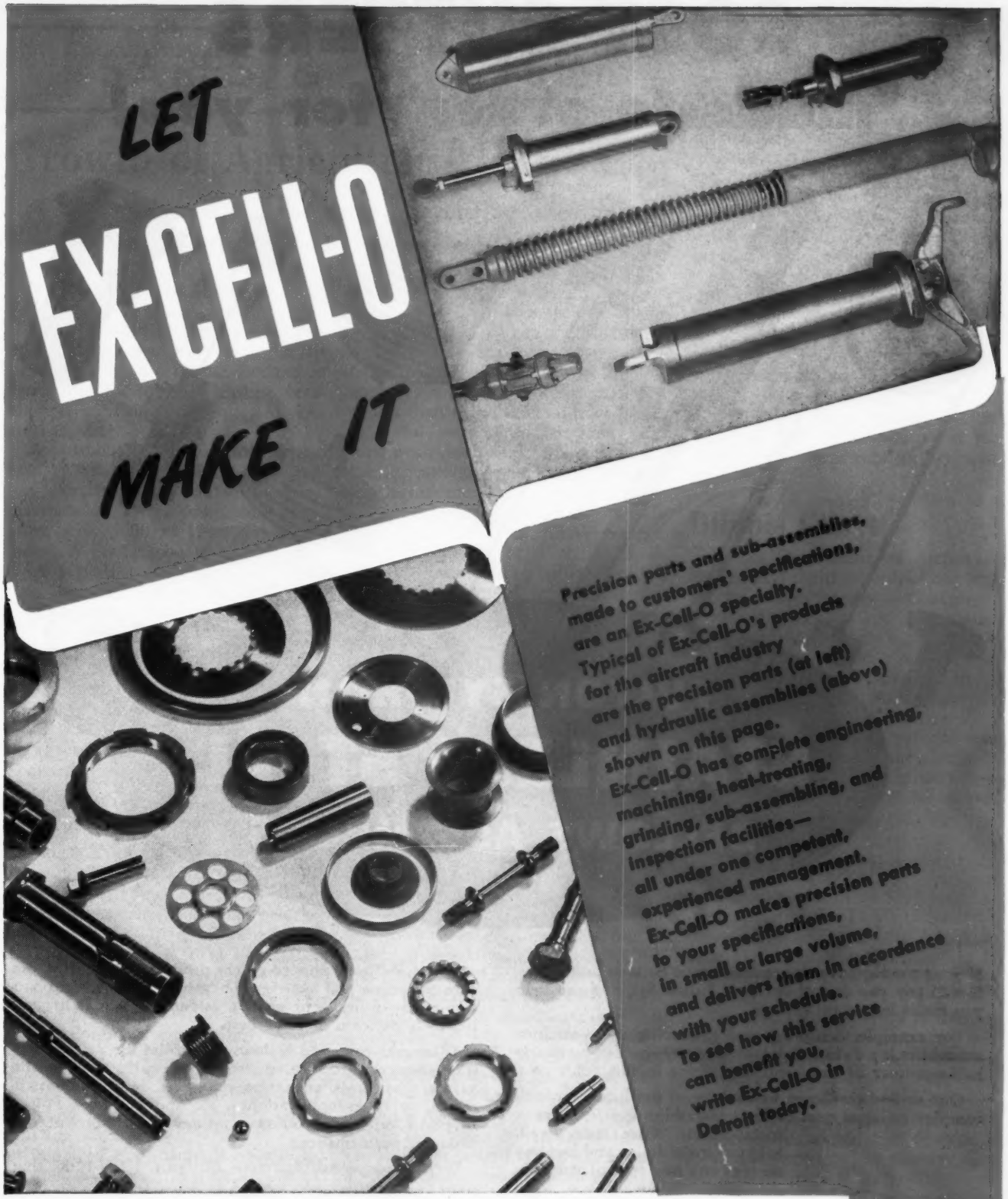
New Model 50 white printing machine produced by **Charles Bruning Co., Inc.**, 4754 Montrose Avenue, Chicago 41, Ill., is stated to be capable of variable printing speeds up to 24 ft. per min. Direct positive prints, without use of intermediate stencils or negatives can be made in black/white or color.



Truing Device

Designed for truing diamond wheels of all bond types with the exception of resonoid bonded diamond wheels finer than 220 grit, a brake-controlled truing device is being made by **Norton Co.**, New Bond Street, Worcester 6, Mass. Unit is said to be self-contained and driven by the wheel to be trued, rather than by a separate motor, obviating need for reducing the speed of the diamond wheel during the truing cycle.

LET EX-CELL-O MAKE IT



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SALES & SERVICE

Growth of Agricultural Plane Use

Aircraft employed for spraying, dusting, seeding and fertilizing increase from 5000 to 8000 in one year.

By Alexander McSurely

While non-airline civil aviation generally has been marking time in the last two years, the use of the airplane in agriculture—for spraying, dusting, seeding and fertilizing—has expanded with great rapidity.

Approximately 8000 aircraft were used by commercial operators for seeding, crop treatment and insect extermination in 1949, compared to approximately 5000 in 1948, CAA estimates. A survey soon to be started in CAA regions is expected to provide more complete information as to the number of operators and their planes and uses by the end of this year.

► **Plane Uses**—Major uses of planes and number used in each category is estimated as follows:

	No. of Planes	
	1948	1949
Dusting	1883	3000
Spraying	1327	2000
Seeding	1077	2000
Fertilizing	768	1500
Urban insect spraying	119	262

Equipment used includes both relatively high-powered aircraft—usually converted war surplus training planes—and lightplanes. An incomplete record in CAA files showed 2833 lightplanes of up to 1500 lb. gross weight, 1431 planes of 1500 to 5000 lb., 4 over 5000 lb., and 8 helicopters. Hugh Mitchell, former Louisiana crop-dusting operator, assigned by CAA as flight operations specialist for industrial aviation, believes the actual division between light and heavy planes is more equal than this record indicates.

► **Examples Cited**—Mitchell cites as an example: the Ziegler Flying Service at Jennings, La., which recently purchased 60 PT-17s for conversion to dusting and spraying. Another example on the lightplane side is Willard Worsham of Taft, Tex., operating 24 Piper J3s and 1 PT-17.

Most sprayers and dusters are home-built modifications although at least three lightplane companies in the last year have made efforts to market planes with factory-installed dusting and spraying equipment (Piper, Aeronca, Luscombe).

► **Special Plane**—Spraying and dusting business has grown to a size that warrants manufacture of a special airplane for the purpose. When it is considered that leading U. S. personal plane manufacturers have shipped less than 3000 airplanes in the first 9 months of 1949, or less than half the number of planes estimated by CAA as used for agricultural work this year, the importance of the agricultural plane market takes on new significance.

A new development project now in early stages at Texas A&M College, under leadership of Prof. Fred E. Weick, inventor of the two-control Ercoupe, is expected to result in the first postwar plane specially designed for this purpose, with flight characteristics, power and payload sufficient to out-perform the higher-powered trainer modifications now most commonly used.

► **Triple Sponsorship**—The Weick design is under triple sponsorship of the college, the Fourth Region CAA and the Flying Farmers Assn. Original understanding was that it might be financed partially by CAA as a development project, but that independent financing would be sought for it if government funds were not available. Current indications are that Congress will not provide the development funds.

Recent appointment of George Childress, in charge of aviation development for agricultural aviation at CAA was at least partially aimed at handling this project along with other similar development work.

► **Weick Design**—Weick's design is described as a low-wing monoplane configuration using a 185 hp. powerplant with a stall speed of around 45 mph. and ability to sustain level flight around 60 mph. with good maneuvering at this speed.

Other recent developments in airplane spray and dusting:

• **Department of Agriculture** at Beltsville, Md., recently witnessed a demonstration by Air Force Medical Service using quick demountable 25-gallon DDT dispersal tanks, slung in pairs beneath the wings of a Consolidated Vultee L-13 liaison plane. Small wind-driven propeller at rear of each tank disperses liquid as a spray. Plane flew 80 mph. at an altitude of 25 ft., sprayed a swath of land 150 ft. wide and 8 mi. long with a 25% DDT solution in 6 minutes. Tanks can be mounted or removed in five minutes.

• **Iowa State Aeronautic Commission** has recommended a state regulation making installation of stall warning indicators on all crop dusting and spraying airplanes operating in the state mandatory, as a result of analysis of a series of recent accidents. Use of shoulder harness by all spraying and dusting pilots is also recommended.

• **Department of Agriculture,** working with farmers and state officials in Wyoming, has recently attacked by air the 10-year cyclic pest of grasshoppers, covering 2.7 million acres with a poison-loaded bran bait dropped from planes at the rate of 5 lb. bait to the acre. Thirty-seven planes, including three Department of **Agriculture planes** were used. Kill of 90 percent in 7 days was reported.

Illinois Chart

Illinois Department of Aeronautics has issued a multi-colored Illinois aeronautical chart, for free distribution to private pilots.

Included in the chart is a breakdown of Illinois airports and a mileage computer between cities. An inset in the map shows plotting instructions and another contains safety hints.

Navigational facilities, such as radio range, omni-range, etc., are clearly indicated. Map may be secured from State of Illinois, Dept. of Aeronautics, Capitol Airport, Springfield, Ill.

Swift Reduction

Announcement of an $810 reduction in the price of the TEMCO Swift 125 two-seater deluxe plane, to $3685 fly-away Dallas, is seen as preparation for introduction of a new 145 hp. Swift early next year.

The new higher-powered version, developed after tests by Texas Engineering & Manufacturing Co. with a 145 hp. tandem trainer for military sales, is to sell in the $6000 price range.

The $3685 price for the 125 hp. Swift includes as standard equipment: an Aeromatic propeller, two-way General Electric radio, position lights, oil cooler and other extras. The all-metal plane is powered with a 125 hp. Continental engine, has an advertised 140 mph. cruising speed, and is equipped with retractable landing gear and hydraulically-actuated flaps.

Special price will be effective only until the current stock of 125 hp. Swifts is exhausted. Afterward the company expects to build the 125 on special order only, at a price higher than the previous $4495. Main production from now on will be concentrated on the 145 hp. Swift.

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SEABOARD AND WESTERN'S Arthur and Ray Norden see regular flights . . .

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Who Should Fly Atlantic Cargo?

Seaboard and Western argues all-cargo carrier would be most efficient. Certificated lines disagree.

The fight over who is going to carry most of the air freight across the North Atlantic moved last week from the sales offices of the competing carriers to a hearing room of the Civil Aeronautics Board.

The basic issue before Examiner Warren E. Baker in the applications of Seaboard and Western Airlines and Transocean Air Lines for certificates to operate all-cargo service is similar to the one the Board faced in the domestic cargo case: whether hauling freight should be reserved to the already-certificated passenger carriers.

But before he can come to grips with that issue, Examiner Baker is going to have to weigh a new system of handling international commerce.

► **Advantage of Air**—Point-to-point, one-carrier cargo service from the interior of the U. S. to land-locked European countries is, of course, possible only by air. It saves time, naturally, but perhaps more important, it often saves expensive packaging and therefore money. So this system should vastly increase the air freight potential across the North Atlantic.

That is one of the strongest reasons why Seaboard and Western instigated the present hearing by applying, two years ago, for permission to operate from the New York, New England and Great Lakes areas to Europe and the Middle East. Ranged against SWA is Transocean, which wants to serve about the same areas, and the three U. S.-flag certificated carriers, Pan American Airways, American Overseas Airlines and TWA.

► **Who Profits?**—The certificated carriers are in a peculiar position. They will not argue SWA's contention that there is a very real potential in trans-Atlantic air freight, and at least one (PAA)—says it carries more trans-Atlantic freight right now than Seaboard—which lays claim to being the largest all-cargo carrier. The question is whether that potential will support an all-cargo carrier—and the certificated lines. The latter fear diversion of revenue if Seaboard is certificated. But at the same time, Pan Am, at least, says it loses money on cargo operations and insists that Seaboard does, too.

Seaboard's figures show a profit ever since it has been in business. But the certificated airlines say it was the Berlin Airlift support work that enabled Seaboard to turn in a heavy profit last year—its best year so far.

Seaboard's answer to that is that the certificated lines had an equal chance at the Airlift support business, and didn't have the planes to handle it. SWA's case features prominently that very point: that the Airlift was a national defense emergency and that the passenger-carrying lines weren't geared to contribute enough to the national defense needs.

Only an all-freight line, says Seaboard, can perform adequately when a national emergency demands airlift. And the certificated lines' answer to that is the reason Seaboard is in business at all.

► **Filling a Vacuum**—It is the now-familiar story of a vacuum in air service and a company stepping in to fill it. Immediately after the war, the equipment-short certificated carriers had all they could do to handle their passenger business. The cargo was there and new companies organized to carry it, both domestically and internationally. Seaboard was one of those companies.

When the Airlift support work came along last year, the passenger airlines had begun to go after cargo business with all-cargo flights, but still did not have enough cargo planes to meet Air Force needs. Pan American, for instance, says it would have had to pull passenger planes off its Pacific routes to operate more Airlift support flights.

But PAA feels that would not be necessary in the future, for it is building up its cargo service and fleet. Now it operates three all-cargo flights a week to Europe and TWA operates one each way a week. AOA has dropped its all-cargo service. In short, the certificated carriers think that if SWA ever filled a need that need has passed. And, the

certificated carriers warn, for every dollar of freight carried by Seaboard, a dollar must be added to the mail subsidy of the U. S.-flag carriers. In addition, PAA is quick to point out that foreign-flag carriers are increasing their share of freight carriage.

▶**Little Giant**—Significantly, in the statements and exhibits submitted to the hearing by the three certificated carriers, the main target is Seaboard. Pan American, in particular, has done an extensive job of breaking down SWA's figures, analyzing them, and submitting answers. This, in itself, is a measure of the effectiveness of three-year-old Seaboard and Western Airlines, and of the aggressiveness of the Norden brothers who founded the company.

Raymond A. Norden, 33, president, started writing aviation insurance in 1934, and was assistant branch manager of the Chicago office of Aero Insurance Underwriters when the U. S. went to war. He served with the Air Transport Command as a pilot and later a staff officer and came out as a captain. His brother Arthur, 35, vice president and treasurer of Seaboard, also was in aviation insurance prior to the war and also served in the ATC, as a major in charge, at one point, of flying safety for the India-China division which operated the "Hump" route.

▶**Busy Planes**—It is a small, compact company with only 126 employes and five C-54 aircraft, two of which are owned, the others leased. Since its first revenue flight May 10, 1947, Seaboard has flown more than 8.5 million ton miles, carrying everything from watches from Switzerland to elephants from Malaya.

By the spring of this year, SWA had made 584 North Atlantic crossings, and flown nearly 3 million revenue miles.

Seaboard reports it has made a profit continuously since it has been in business: $7966 for the year ending Aug. 31, 1947; $13,392 for the year ending Aug. 31, 1948; $179,311 for the four months ending Dec. 31, 1948. Report for the fiscal year ending Aug. 31, 1949 is not yet out. (PAA, in its rebuttal to SWA's exhibits, claims Seaboard lost a total of $150,500 in the first six months of 1949.)

By persistently beating the bushes for air freight, the Nordens' line has carried about 2.3 million pounds in a little more than two years. Seaboard estimates that, granted a certificate that would permit regular operations, the air freight potential is 700 million pounds a year. The first year with a certificate, Seaboard would operate an average of one roundtrip a day to Europe. In the second year, it says it would operate about ten roundtrips a week.

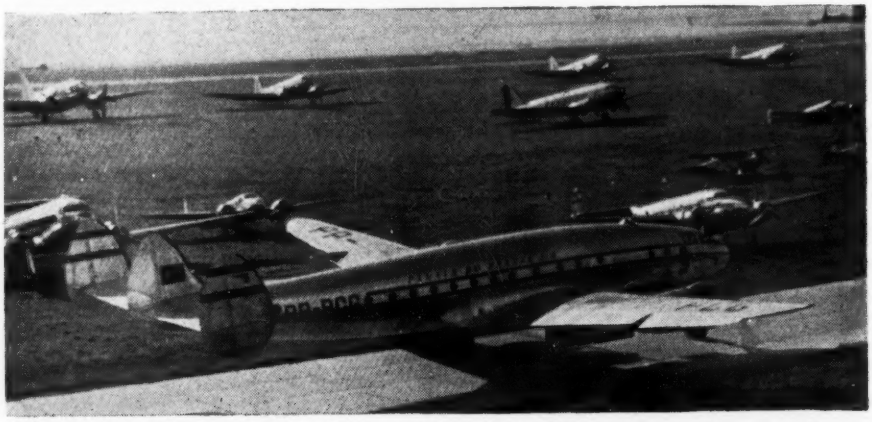
▶**Feeder Service**—Most of the freight has been eastbound. Seaboard has its own plan for trying to overcome the constant worry of partial loads westbound. It is a feeder service from the Near East and eastern Europe to Geneva or Brussels, the two points where Seaboard generally originates its westbound flights. For this operation, SWA would use C-46s.

For the first three months of this year, SWA's cargo ton miles, 1,214,449, showed a healthy increase over the same period of 1948. But this year there probably will not be the heavy military shipments which boosted the line's third-quarter 1948 figures to astonishing highs (839,207 cargo ton miles in July, 1948, for example) and enabled it to end the year 5,493,103 cargo ton mi.

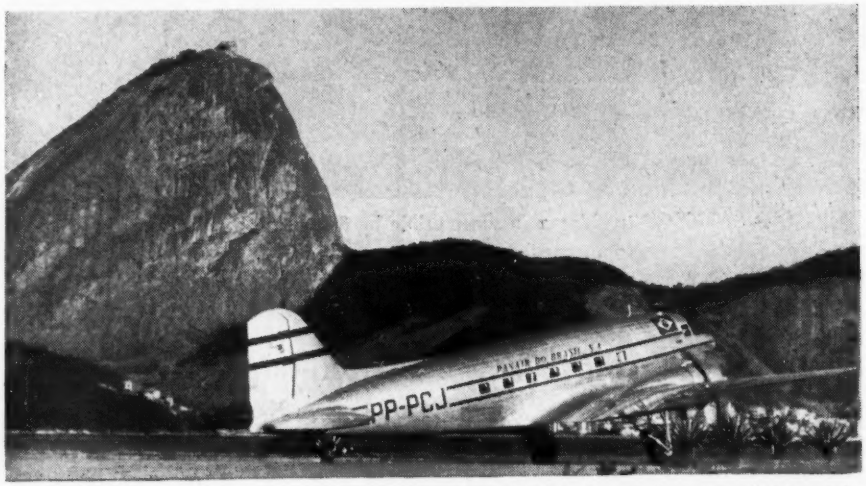
Meanwhile, Pan American's Atlantic cargo has been growing at a terrific clip. For the full year 1948 it was 5,734,236, for the first six months of 1949, 4,324,687.

The other certificated carriers also have been increasing their cargo ton miles. At that rate of progression, the certificated carriers, within the time it takes to get a decision out of CAB, could very well demonstrate that there was no need for an all-freight carrier across the North Atlantic.

But if Seaboard or the examiner is ever successful in breaking down the complicated statistics of the certificated lines, the result could well be the most powerful argument yet for an all-freight service over the ocean.



CONSTELLATIONS for Panairdo Brasil's South Atlantic routes to Europe, and . . .



DC-3s for domestic routes take off in the shadow of Rio's famed Sugar Loaf Mountain.

Panair do Brasil Spreads Its Wings

Expanding carrier becomes big transocean operator flying 21,550 miles externally. PAA is easing out.

(*McGraw-Hill World News*)

By Henry W. Bagley

RIO DE JANEIRO—Brazilians are running South America's biggest airline, Panair do Brasil. It was started, and for years operated by outsiders. Then it was a small coastal line; now it is controlled and operated by Brazilians and has become a big-time transocean carrier.

Pan American Airways, which estab-

lished the line, now holds only 48 percent of the stock; the majority is in the hands of Brazilians. With only about 40 Americans left on the company roster, policy is to replace Americans with Brazilians whenever possible.

In 1948, Panair do Brasil flew over 10,260,000 miles, an increase of 37 percent over the previous year. It carried 199,398 passengers, up 42 percent over 1947.

Panair do Brasil flies all over Brazil, as well as south to Buenos Aires and Montevideo and across the South Atlantic to London, Paris, Rome, Istanbul, Cairo and Beirut. Its lines extend more than 50,000 miles, of which 21,550 are outside Brazil.

▶ **Brazilians Have Key Posts**—Actively running the show is Paulo Sampaio, 42-year-old president, who has headed the company since 1943. Guilherme Guinle, wealthy industrialist and hotel man, is chairman of the board of directors, whose members include some of Brazil's top businessmen.

Pan American Airways keeps its hand in the company direction, with an American, John Clyde Younkins, as treasurer, and another, Humphrey Wallace Toomey, on the board of directors. In fact, Pan American probably still is in a position to dominate the line, inasmuch as it would be next to impossible for the Brazilian stockholders, some of whom live in distant parts of the country, to express themselves in sufficient near-unanimity to over-balance the 48 percent of the stock which Pan American owns.

▶ **Planes and Crews**—On its international flights, Panair do Brasil uses five L-49 Constellations. It started European service in March, 1946, and claims it has "never missed a schedule" on the South Atlantic run. (Of course, weather and engine trouble have on some occasions delayed flights.)

North Americans first piloted the Constellations, but now Panair do Brasil has ten Brazilian captains fully qualified as master pilots for long range flights, and ten more Brazilian captains are in training to become master pilots. Five American captain instructors remain with the company. In each crew of nine, a Panair Connie has a maximum of one American captain and one American flight engineer.

Thirty-five Americans work in flight dispatch, inspection, engineering, master mechanics and management, as technical advisors.

Panair's total personnel, in 1948, was 3949, of whom 84 were captains. Deducting the 10 captains on the Constellation runs, Panair has 74 chief pilots on its national lines.

For those services, there are 16 DC-3s and 3 C-47s on the regular routes in eastern, central and southern Brazil, and four Catalina PBY-5As on the Amazon

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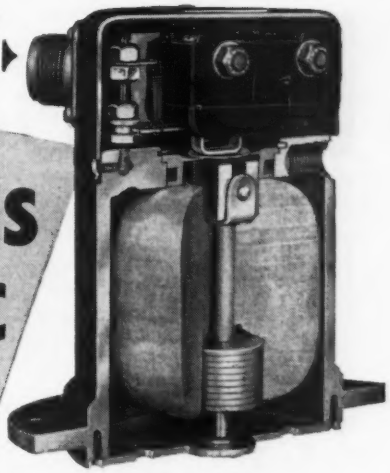

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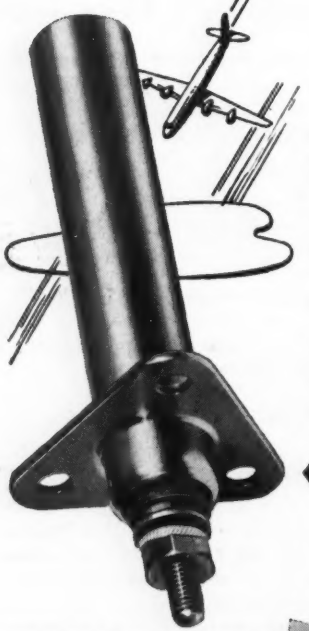

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valley routes, where landings are usually made on water. Panair gets a government subsidy on a mileage basis for the Amazon operations where no other regular airline flies. In that way the interior cities of Manaus, Porto Velho, Benjamin Constant and others get regular service which in some cases would lose money for Panair.

▶ **How It Began**—The Amazon service was one of Panair's first. It was started in 1933, three years after the company was created, with the 800-mile flight between Belem, at the Amazon's mouth, and Manaus, 800 miles upstream. Then, as now, amphibians were used in the long hops over jungle land; the countless broad, meandering rivers afford plenty of sit-down space in the sparsely inhabited areas, where landing fields are few and far between. In the early days, the planes were Sikorsky S-38s; then came single-engine Fairchild 91s. Later Panair tried the Douglas DC-3 on the Belem-Manaus run, but went back to amphibians last year with the Catalina PBY.

Panair do Brasil came into existence in 1930 after Pan American Airways bought NYRBA (New York-Rio-Buenos Aires Line) and NYBRA do Brasil. The first Panair do Brasil plane flew mail from Belem to Santos, with an American crew, Nov. 28, 1930, but it was not until Mar. 2, 1931, that Panair started its first Brazilian passenger operations, with a weekly flight between Belem and Santos. The route was along the Brazilian coast, and the planes were amphibians. Later in 1931, Panair do Brasil branched into the international field, with flights to Buenos Aires.

By 1935, Brazilian flight personnel was beginning to take over from Americans, and in September, 1938, the last Pan American Airways pilot flying for Panair do Brasil was replaced. Since then, the Americans have been consistently weeded out. In answer to the question, "Is it general policy to replace American by Brazilians in Panair jobs wherever possible?" a Panair official replied: "Definitely."

▶ **Routes**—On the European flights, Panair do Brasil has, to some extent, dovetailed its operations with those of Pan American Airways, obtaining permission to fly to some points from which Pan American is barred by international agreements.

Panair do Brasil crosses the South Atlantic eight times per week. The weekly crossings for other companies in the field are: KLM 4, Air France 4, British South American Airways 4, Scandinavian 2 and Alitalia 2.

The Brazilian line was the first to put 8000 hours on a Constellation.

Panair do Brasil operated for eleven years before it had its first fatal accident—the crash of a Lockheed Lodestar in São Paulo. There have been others,

including a practically unavoidable disaster when an amphibian struck a submerged log in an Amazon River landing, but by and large the record is good. On the European run, no fatal crash has occurred.

▶ **Ground Facilities**—Panair has its own flight control and meteorological services, as well as repair and machine shops. Most of this work is done in the Panair hangar at Santos Dumont airport in Rio, where there are also classrooms and workshops for apprentices. Constellations are overhauled in the United States, but servicing is done at Rio. Pan American Airways pays Panair do Brasil for the many services provided to the U. S. company in Brazil, and competing lines also make use of some of Panair's facilities.

For several years, the company showed a tidy profit. Then in 1947 and 1948 came the struggle between the bigger Brazilian lines and several small competitors, some fly-by-night operators. The air was jammed with DC-3s, and rate-cutting was everyday procedure. Panair showed only a small profit in 1948, and issued no dividend. This year, tighter controls by the Brazilian government and the collapse of some of the weak sisters make Panair's prospects better.

Trans-Atlantic Lines See Record Traffic

Trans-Atlantic airlines expect to generate record winter business from twin fare reductions that went into effect this month.

Pan American Airways believes U. S.-Europe travel will be up half-again over last winter as a result of the 25 percent off-season reduction now available on 60-day roundtrip excursions, plus the effect of foreign currency devaluations. TWA, American Overseas Airlines and foreign carriers also predict traffic gains.

Under the excursion rate, which is valid through next March, roundtrips from New York to London will cost $466.70 instead of $630. New York-Paris fares will be $493.30 instead of $666. Foreign flag lines, including Air France, BOAC, KLM, Sabena, Scandinavian Airlines System, Swissair and Trans-Canada Air Lines, are participating in the reduced tariffs.

▶ **Dollar Stretched**—Currency devaluation has no effect on dollar fares from the U. S. to European gateway points such as London, Paris, Shannon and Lisbon. But beyond the gateways, in the sterling area, a dollar will buy considerably more mileage.

TWA says its fares to non-gateway points in Europe, North Africa, the Middle East and India will be lowered from 4 to 19 percent because of devaluations in sterling bloc nations. PAA points out that American businessmen and tourists going to sterling areas will also benefit from reductions up to 30 percent in the price of hotel rooms, meals and other purchases.

Trans-Atlantic carriers already have experienced record traffic this year. TWA reports its international passenger business during the first seven months of 1949 was up 27 percent over the same 1948 period.

Next year, TWA looks for another 15 percent increase in overseas passenger volume. And it believes the winter fare bargains will go a long way toward minimizing seasonal traffic fluctuations.

Standardization Veto

The domestic airlines have lined up against the Civil Aeronautics Board's proposal to standardize cockpit arrangements on all transport aircraft (AVIATION WEEK, July 18).

In comments submitted to CAB's Bureau of Safety Regulation, the carriers indicated belief that the Board's standardization plans are much too specific. They are especially opposed to making such standardization retroactive.

▶ **Suspicion Expressed**—Some airline officials expressed suspicion that CAB lifted its cockpit standardization ideas almost verbatim from studies on single-pilot military aircraft and tried to apply them to multi-pilot commercial planes.

The carriers said they believe in standardization "to a certain degree." They added that they were willing to cooperate in attempts to secure additional cockpit standardization if airframe manufacturers, airline pilots and the carriers have an opportunity to express their opinions, and if these opinions are given proper weight.

Better Mechanics Goal of Airlines

A program enabling aviation technical schools to turn out more fully qualified graduates for airline employment has been outlined by the Airlines Mechanics Committee of the Air Transport Assn.

At a recent meeting with the ATA group, representatives of 26 leading U. S. aviation technical schools agreed to follow the program, which calls for upgrading the school's curricula for those students specializing in airline maintenance. Both the committee and school representatives agreed there would be no standardization of the program. It will be worked out individually through groups representing the technical schools.

▶ **CAA View**—A Civil Aeronautics Administration official at the meeting indicated his agency would like to see the Civil Air Regulations amended to

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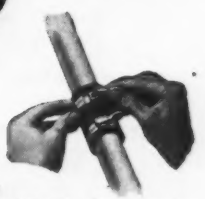

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raise the present minimum requirements for A&E licenses in accordance with recommendations of ATA. He said the present single classification for mechanics should be retained.

The Civil Aeronautics Board in the past has sought to create different classifications of mechanic specialists.

FSF Seminar

Demonstrations of crash-fire rescue operations, the Zero Reader and Dehmel flight simulator will be features of Flight Safety Foundation's second safety seminar on air transportation, to be held Oct. 19-21 at the Bachelor Officers Quarters, Navy Special Devices Center, Sands Point, L. I., N. Y.

Topics tentatively on the agenda include an inquiry into service testing of air transport prototypes; progress survey in cockpit simplification; progress toward avoidance of turbulence, hail and ice; survival rescue apparatus and techniques; developments to reduce fire in flight and following crash; and a brief review of unsolved safety problems.

Attending the sessions will be operations personnel of airlines, aircraft and engine manufacturers.

NWA Fares

Northwest Airlines' proposed three-level passenger fare structure (AVIATION WEEK, Aug. 29) has been suspended 90 days by the Civil Aeronautics Board pending an investigation.

The tariff would have continued four-cents-a-mile air coach fares and the current six-cents-mile level for Stratocruiser service. But tickets on regular DC-4 and Martin 2-O-2 schedules would have been cut to five cents a mile from the present six cents.

Also suspended by CAB was Northwest's plan to offer systemwide, 30-day roundtrip excursion fares for only 150 percent of the regular one-way fare. American Airlines, Capital, Mid-Continent and United protested NWA's tariff changes and asked for the suspension.

Tiger Expansion

The Flying Tiger Line, Burbank, Calif., plans to expand cargo service under its recently-awarded certificate on "a very cautious basis," according to President Robert W. Prescott.

He said that "while our present financial condition is comparatively good, we do not have the financial resources to develop fully all services authorized."

Plan Feeder Merger

Merger agreement whereby Monarch Air Lines will acquire the controlling stock interest in Challenger

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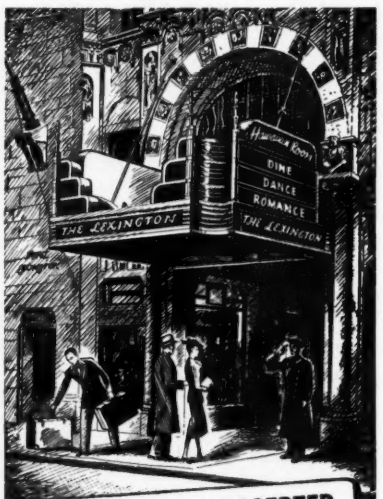

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Airlines Co. has been submitted to the Civil Aeronautics Board for approval.

The two Rocky Mountain feederlines have had consolidated traffic, sales, station, advertising, maintenance, overhaul and engineering activities since early 1948. Both are based at Denver and operate DC-3s.

Previously, Monarch had asked CAB approval of a merger agreement with Arizona Airways, Phoenix, a feeder which has been unable to activate its system because of financial difficulties (AVIATION WEEK, July 25). If the two merger deals are approved, a super feeder system of 4240 route miles extending from Billings, Mont., to the Mexican border will result.

PAA-AOA Merger Hopes Strengthened

In agreeing to pay cash for American Airlines' controlling interest in American Overseas Airlines, Pan American Airways is believed to have strengthened materially the prospects of the deal's being approved.

A cash payment of $17,450,000 was provided in extending until Mar. 13, 1950, of the first sales agreement (AVIATION WEEK, Sept. 19). The new terms are so favorable to AOA stockholders that they may alter the original objections of American Export Airlines, a 20 percent holder of AOA stock, and a vigorous opponent of the merger.

▶**Voting Trust Eliminated**—In addition, the cash transaction would eliminate the voting trust that would be necessary under the original stock payment offer. This may remove one of CAB's objections to the consolidation.

Purchase through the stock medium would have been effected at the book valuation of PAA's equity. In the special audit made for this purpose, PAA's net book value was found to be $15.79 per share as of Dec. 31, 1948. The average cost of $10.77 per share of AOA to American was established as the price to be paid for this stock in the exchange or a total of $18,845,651 for all of AOA's assets.

Accordingly, 1,193,844 shares of PAA would have been issued for AOA. However, with PAA now selling around $9 per share, a total market valuation of about $10.7 million would be indicated as the most that could be realized by AOA stockholders. With the revised agreement calling for an all cash transaction, it is obvious that AOA shareholders will receive something like $6.8 million more in cash.

▶**Capital Appreciation**—American owning 61.9 percent of AOA's stock stands to receive about $10.8 million for its stock, if and when this contract is consummated. The new exchange terms also can provide Export with a capital

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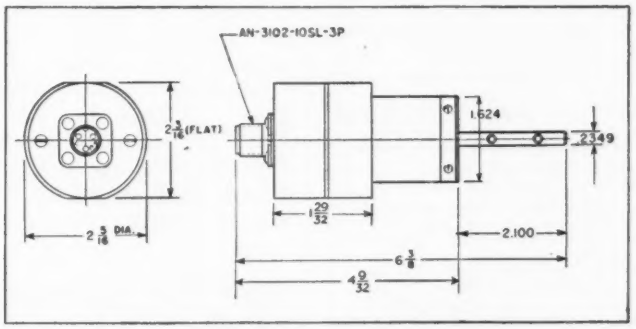

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American stands to benefit more immediately from the separate new loan agreement effected by AOA as a companion measure to the revised exchange proposal. At the present time, American has advanced $1.5 million to AOA in the form of subordinated notes. Further, American was committed to lend AOA another $1.5 million in similar notes. The new loan agreement provides AOA with a $10 million credit which will not only remove the $1.5 million potential commitment of American but will also facilitate the return of the $1.5 million previously advanced.

In order to finance the all-cash transaction, PAA has recently arranged for a new bank credit in the amount of $59 million. This will also permit the carrier to complete its equipment acquisitions, largely represented by Boeing Stratocruisers. PAA will stand to benefit by the revised terms of the acquisition proposal in obtaining the benefit of the lower cost price as contrasted to current replacement values for the Boeing Stratocruisers owned by AOA.

Nonsked Lines Lessen

The number of nonscheduled operators continuing to hold effective letters of registration as large irregular carriers is sinking far below the 100 mark.

Nineteen more uncertificated companies with transport-type equipment may have their letters of registration suspended by the Civil Aeronautics Board on Oct. 12 for failure to file complete statistical or flight reports.

► **Carriers Listed**—Affected: Argonaut Airways, Miami; Conner Air Lines, Miami Springs; Meteor Air Transport, Teterboro; Modern Air Transport, New York; Monarch Air Service, Chicago; Oswald Alaska Airways, Tacoma; Pacific Alaska Air Express, Seattle; Parr Air Service, Philadelphia; Pearson-Alaska, Inc., Anchorage; E. E. Saldana, San Juan, P. R.; Samoan Area Airways, Honolulu.

Stewart Air Service, Los Angeles; Strato-Freight, Inc., Windsor Locks, Conn.; Transair, Inc., St. Petersburg, Fla.; Trans-Alaskan Airlines, Seattle; Trans-National Airlines, Long Beach; Twentieth Century Air Lines, Charlotte, N. C.; and World Airways, New York.

Ask Pay Increase

Pan American Airways wants its mail pay in the Latin American area doubled because of severe losses this year.

The company told the Civil Aeronautics Board that with present temporary mail rates it was $7,700,000 in the red on worldwide operations during the first half of 1949. Of the total, $3,493,-

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000 represented Latin American division losses.

▶**Rates Compared**—In asking that its present Latin American division mail pay be increased from 25 cents to 50 cents a plane mile retroactive to Jan. 1, PAA said it is now receiving only one-sixth the rate given Braniff Airways and one-seventh the rate of Chicago & Southern Air Lines in the same area.

Pan American explained it needed the money badly for payments on the 16 Stratocruisers already delivered and four more to be received shortly. The carrier said increased competition from foreign and U. S. carriers and dollar shortages in Latin America are hurting both passenger and cargo business.

SHORTLINES

▶**American**—Has modified its entire fleet of 74 Convair-Liners at a cost of about $3500 per plane to provide water injection for the Pratt & Whitney R2800-34 engines. The move has increased Convair-Liner gross takeoff limit from 39,000 to 40,500 lb.

▶**BOAC**—Has withdrawn its Liberators from Montreal-London service. The converted bombers have been on the route for eight years.

▶**Central Airlines**—The Fort Worth feederline has asked CAB for a new route between Texarkana, Tex./Ark., and Memphis.

▶**European-American Airlines** — Has asked CAB for a certificate to conduct all-cargo service between the U. S. and Europe. The company has no planes and is not now operating, according to Albert E. Dickens, president. Headquarters are in Washington, D. C.

▶**Helicopter Air Service**—The certificated Chicago area operator has asked CAB for a mail rate of $1.45 a plane mile through Feb. 28, 1950, and $1.20 a plane mile thereafter. Company's Bell 47-Ds are now operating on a shuttle route between the Municipal Airport and the downtown post office building, and on one circular suburban route radiating from the airport. A second suburban route is to open this month and a third in November.

▶**Los Angeles Airways**—Operated its Sikorsky S-51 helicopters about 498 revenue hours in August and flew 7,243,302 lb. miles with a 98.79 percent trip performance factor. Fuel consumption was 30.64 gal. per hour. Operating expenses per revenue mile flown totaled $1.08.

▶**National**—Reports summer passenger traffic was the best since 1946. It was 65 percent above last year (during the strike) and 17 percent over 1947. President G. T. Baker credits summer excursion fares with sparking the upswing.

▶**Pan American**—Latin American Division Manager Humphrey W. Toomey predicts PAA will be using jet transports on trans-Caribbean routes in the "next few years" which will make the 1166-mi. Miami-Panama run in about 2 hr.

▶**Philippine Air Lines**—Philippine National Development Corp. has approved the carrier's application for a $1,250,000 loan to operate an aircraft overhaul plant.

▶**Pioneer**—Early this month planned to test the Swedish-built, 32-passenger Scandia transport over its feeder routes. Several weeks earlier, the company made a test run with the Super DC-3.

▶**Qantas Empire Airways**—The Australian carrier reported an operating profit of £104,384 ($337,116 at old rate) in the last nine months of 1948 and declared a 5 percent dividend.

▶**Slick**—Recently inaugurated scheduled freight service to Boston, Cleveland, Pittsburgh, Dayton and Kansas City. It now serves 17 points on its certificated transcontinental routes.

▶**Southern Airways**—Is now serving 20 of the 23 cities to which it is certificated. The feeder's other three points lack adequate facilities.

▶**TWA**—Has booked 30 college and professional football teams for special flights this fall. . . . Company reported a new record for domestic on-time performance during August when average lateness of all scheduled departures dropped to 8.6 minutes.

CAB SCHEDULE

Oct. 10—Hearing on CAB investigation of International Air Transport Assn. agency resolutions. (Docket 3350)

Oct. 10—Oral argument on Linea Aeropostal Venezolana's application for Venezuela-New York-Montreal foreign air carrier permit. (Docket 3751)

Oct. 10—Hearing in Monarch-Arizona Airways merger case. (Docket 3977)

Oct. 11—Hearing on application of Aerolineas Argentinas FAMA for Buenos Aires-New York foreign air carrier permit. (Docket 4104)

Oct. 13—Oral argument on service to Socorro, Hot Springs and Las Cruces, N. Mex. (Docket 3271 et al)

Oct. 17—Prehearing conference on CAB investigation of Twin Cities-Washington and Detroit-Washington service. (Docket 3661)

Oct. 17—Hearing on service to Springfield, Mass., through Bradley Field. (Docket 3748 et al)

Oct. 17—Hearing in air freight tariff agreement case. (Docket 2719 et al)

Oct. 18—Hearing on required communications equipment for aircraft on long overwater flights.

Oct. 24—Oral argument in New England service case. (Docket 2196 et al)

Oct. 25—Reopened hearing in PAA-AOA North Atlantic route transfer case. (Docket 3589 et al)

Nov. 14—Hearing on final mail rate for Florida Airways. (Docket 3695)

Dec. 5—Hearing in New York City area helicopter case. Postponed from Nov. 14. (Docket 946 et al)

Dec. 5—Hearing in Western-Inland mail rate case. (Docket 2870)

Jan. 9—Hearing in air freight rate case. (Docket 1705 et al)

Jan. 15—Hearing in Colonial Airlines mail rate case. (Docket 2724)

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(Classified Advertising)

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STRICTLY PERSONAL

BLOWING HIS TOP—**Bill Greenlee** says during a recent day off **Fred Bailey**, American Airlines pilot operating out of Chicago, was spouting about his prowess with the shooting irons. **Si Bitner,** chief AA pilot at Memphis, offered to let Fred prove it by tossing his hat into the air; if Fred holed it, the drinks would be on Si, etc. Up went the hat. Bam-bam. Fred's shots were dead center. As Si retrieved the hat Fred got hysterical. "What's the joke?" says Si. "It's your hat," says Fred.

* * *

TRIBUTE TO A FINE GANG—We're sorry to see **Capt. Roy Simpler's** Washington public relations gang disperse. They always worked hard to answer press queries. **Lieuts. Bob John Robison** and **Jim Stacy** are flying Corsairs in Florida. **Lieut. Pappy Fruin** is a Banshee pilot and made the headlines recently by bailing out of his ship at 40,000 feet at something like 600 mph. speed. Capt. Roy himself has been in the special events section of National Military Establishment's public relations. **Comdr. Sam Clark** is a Navy rep on the joint USAF-Navy Standardization Committee. **Capt. Jake Jacoby** has gone to Marine Corps amphibious school at Quantico, and **Lieut. Bill Fey** is in NME's press section. They had many friends in the industry.

* * *

CATHERINE MARK ONE—Several months ago we reprinted an original birth announcement, in aviation press release form, and now threaten you with another. After all, having babies seems to retain a certain popularity. And every new one brings an announcement.

Alamo Airways Produce New Personal Heircraft

Peggy and George Crockett, operators of Alamo Airways at McCarran Field, Las Vegas, Nev., announce the initial showing of their first experimental heircraft, which will be christened Catherine.

Inaugural flight took place at General Hospital, Las Vegas, Sept. 12, 1949, at 02:05, just 9 months from the time engineering and production started.

While this heircraft appears to be of conventional design, the officials of the parent company are boasting of many new and unique features, as follows:

Specifications:

Type: Twin jet, Feederline model.
Gross Weight at take-off: 7-lbs., 5-oz.
Over-all Length: 20 inches.
Fuel Capacity: 4-ounces.
Cruising Range: 4 hours.
Fuel System: Gravity and suction from dual tanks.

Equipment:

Landing gear, retracting, super-flexible.
Water ejection system (automatic).
Howl Flaps.
Radio, VHF (very howly and frequent).
Quick removable tail section for ease of maintenance.

Peg and George Crockett, Production Manager and Designer respectively, emphasize that they do not expect mass production this year, but after the operating difficulties are worked out of the water ejection system, which currently is causing frequent trouble, they may produce a companion model of the single jet type.

* * *

MAYBE A DUN & BRADSTREET RATING—**Warren Merboth** writes from Arcadia, Calif., about a problem that must have perplexed some of the most facile brains in aviation and after we present it to you and CAA we retire in the usual confusion. Says Warren:

"I was associated with the Aerojet tests of the rocket launching of gliders. Two junior JATOs were attached on each side of the fuselage and through a selector arrangement either or all the JATOs could be fired at once. Whereupon a CAA representative was heard to remark, 'Should we require the pilot of this aircraft to hold a glider, power, or multi-engine rating?'" But we suppose CAA hardly had time to decide, because the war probably ended less than three years later.

* * *

THIS HIXON IS A CARD—Northwest Airlines Publicity Dept.'s No. 1 joker, **Carl Hixon,** says Northwest already has Flight Control and Space Control. Now, with the Boeing's, he's first volunteer to help set up Berth Control, one of his "friends" reports.

—R. H. W.

WHAT'S NEW

New Books

"The Airplane and its Engine," by Charles H. Chatfield, C. Fayette Taylor and Shatswell Ober, a new fifth edition of the basic text, including developments in gas turbines, jet, rocket and reciprocating engines. Published by McGraw-Hill Book Co., 330 West 42 St., New York 18, N. Y., price $4.50.

"Analysis and Lubrication of Bearings," by Milton C. Shaw and E. Fred Macks, an advanced work providing material for a senior or graduate course in lubrication theory. Published by McGraw-Hill Book Co., 330 West 42 St., New York 18, N. Y., price $10.

Trade Literature

Brochure from McConnell Air Hostess-Stewardess Schools illustrates training and job potential in these positions. Copies are available from McConnell School, 1030 Nicollet Ave., Minneapolis, Minn.

"Domestic Mail Rate Decisions," a thorough 258-page report outlining and summarizing all the recent Civil Aeronautics Board opinions setting or proposing permanent mail rates for domestic trunklines and feeders. Report is arranged in fourteen sections by subject matter. It covers decisions summarized and rates set; comparable carriers; scheduled services required; flight equipment; non-mail revenues; general operating expense; flying operations expense; direct maintenance expense; depreciation-flight expense; ground and indirect expense; miscellaneous costs and credits; recognized investments; detailed investment adjustments and determination of mail rates. Survey covers 15 carriers. Published by Frederic P. Kimball, consulting economist, 400 Benedict Ave., Tarrytown, N. Y., price $175.

"The CAA Low Frequency Omnirange," by Thomas S. Wonnell and Gerald E. Fenimore, Radio Development division, CAA. Technical Development Report No. 72, available from Civil Aeronautics Administration, Technical Development, Indianapolis, Ind.

Booklet describing rules and conditions for the 1949-50 Engineering Undergraduate Award and Scholarship Program is available from the James F. Lincoln Arc Welding Foundation, Cleveland 1, Ohio.

Bulletin on the new Dillon pressure gage and its applications available upon request to W. C. Dillon & Co., Inc., 5410 West Harrison St., Chicago 44, Ill.

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First issue of each month

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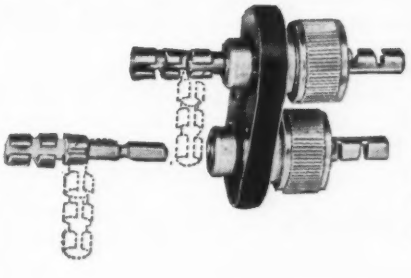

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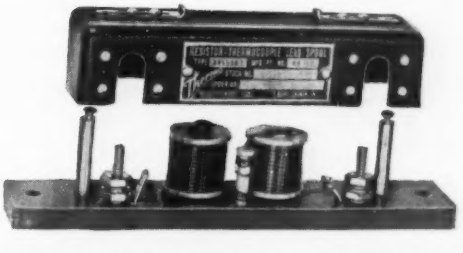

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EDITORIAL

Down This Canard

Once again, this time in an address before the National Security Industrial Assn., Secretary W. Stuart Symington made it clear that the Air Force holds no visions of winning the next war single-handed.

This canard is continually being inflated and hoisted up like a barrage ballon by anti-Air Force propagandists. Just as often, responsible Air Force spokesmen make an honest effort to inform the American people otherwise.

"It is our belief that there should be a joint military team of land-sea-and-air, a team constructed and maintained in accordance with the true definition of balance," Mr. Symington said. "That definition of balance makes me anxious to lay to rest once and for all various rumors that have gone around about the Air Force believing it could win any future war by itself.

"Nothing could be farther from the truth. General Vandenberg, his staff and I have denied this rumor many times."

Mr. Symington pointed out that the Joint Chiefs of Staff and the Secretary of Defense have given the Air Force three main responsibilities:

- Air defense of the United States, including radar warning and control, day interceptors, and night interceptors.
- Tactical support of the operations of both the Army and Navy.
- The capacity to deliver an immediate and sustained retaliatory strategic offensive against any nation which might attack us.

This is no new information to many in aviation. But apparently there are thousands of Americans who have been, and continue to be, misled by the jealous enemies of airpower. In fighting increased appropriations for air they resort to a strange and fallacious argument apart from the merits of the case—that one service selfishly seeks a monopoly on our national security funds.

Self-Policing for Nonskeds

Our friends (and some others) in the scheduled airlines occasionally display what is to us an embarrassing ignorance of this magazine's past editorials about the nonscheduled carriers. But they pretend to quote us anyhow.

It is these readers-once-removed who are brave enough to make the flat statement that we are pro-nonsked, or anti-sked.

Nothing we ever write editorials about is that easy. Certainly not any phase of this air transport business.

As has been said here so often before, we stand for the safest, most economical, efficient air service it is possible to give the American people, at the least subsidy, regardless of who can perform it, sked or nonsked or both.

We believe the nonskeds have accomplished a remarkable piece of pioneering. Some of them leave much to be desired, but we feel that as a group—especially in the passenger field—they have pointed the way to many a scheduled carrier in cutting costs and increasing efficiency. Many frills and extras could be lopped off without making the slightest sacrifice to safety.

Other nonskeds, however, are not doing the public, themselves or their more conscientious independent brethen any service. These we do not wish to defend, and never have defended.

For example, take this interesting background on a nonscheduled passenger flight that a friend of ours reports on, leaving Los Angeles Aug. 26:

Tickets were sold by Arrow Airway. The plane and crew belonged to Strato-Freight, a carrier ordered grounded by the government for technical violations as the aftermath of a crash near San Juan early last summer.

This flight was made under New England Airways' letter of registration. The flight was presumably operated by New England, yet we are informed that Arrow paid only $2100 to Strato-Freight for equipment, crew and fuel, while retaining some $1500 for itself as the selling agency's commission.

Meanwhile, Strato-Freight paid $200 to New England for use of that carrier's $88 tariff and letter of registration.

This is subterfuge and violation of government regulation, as we see it. Such operators endanger the whole cause of the independent nonscheduled air carrier. If we were nonskeds making an honest effort to adhere to government regulations, we should make strenuous efforts to weed out such practices before the government, with an augmented enforcement staff, grasped this as an opportunity to wipe out an entire new industry.

The Copter's Remarkable Progress

Los Angeles Airways celebrated its second anniversary the other day by flying the mail over the sprawling L. A. suburban area right on schedule, as it has done every day, piling up an all-time world mark for operation and maintenance of the helicopter.

Clarence Belinn, Los Angeles Airways' tireless, resourceful president, tells it best:

"Two years ago we stood entirely alone, without a yardstick or prior concept of the art. Today we have 10,000 hours and over 100,000 landings behind us.

"We have carried millions of pounds of mail.

"We have made thousands of changes on the equipment.

"Coupled with this we are seeing a conscientious operator in Chicago just commencing, and now come people like New York Airways to conclude the trans-continental regional picture.

"Frankly, I don't believe that this industry has ever moved so far and so constructively in such a short period of time before, and there is much more to come."

Los Angeles Airways' remarkable record is a reliable clue to the future. The helicopter holds enormous promise Those with vision do not sell it short.

Robert H. Wood.

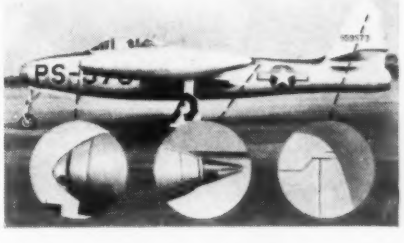
Why McDonnell Banshees have canopies of "Lucite"*

HERE ARE THE MANUFACTURER'S REASONS FOR SPECIFYING DU PONT'S ACRYLIC RESIN

The McDonnell twin-jet F2H-1 Banshee, USN, has been described by its manufacturer as one of America's most powerful fighters... is capable of attaining extremely high speed and altitude. Here's why McDonnell and the fabricator, Swedlow Plastics Co. of Los Angeles, Calif., selected Du Pont "Lucite" acrylic resin for the Banshee's enclosure:

1. "Lucite" is crystal-clear... can be produced to surpass government specifications for optical uniformity... provides undistorted vision.
2. "Lucite" is strong and tough—tensile strength 7-8,000 p. s. i.... flexural strength 12-16,000 p. s. i.
3. "Lucite" is light in weight... approximately one-half the weight of glass.
4. "Lucite" protects personnel—a special-type "Lucite" filters out most sunburning rays.
5. "Lucite" resists weathering... is unaffected by sunlight, rain, and snow.
6. "Lucite" is workable... can be sawed, drilled, beveled, and formed into deep compound curves without special tools.

If you need a transparent material for enclosures or other uses, keep "Lucite" in mind for best results. Mail coupon below for literature on "Lucite" and other Du Pont plastics serving the aviation industry.



REPUBLIC'S F-84 THUNDERJET uses "Lucite" for streamlined coverings on wing and fin-tip lights plus the nose and tail cones of wing tank assembly. "Lucite" transmits 90-92% of visible light... can edgelight or "pipe" light around curves.

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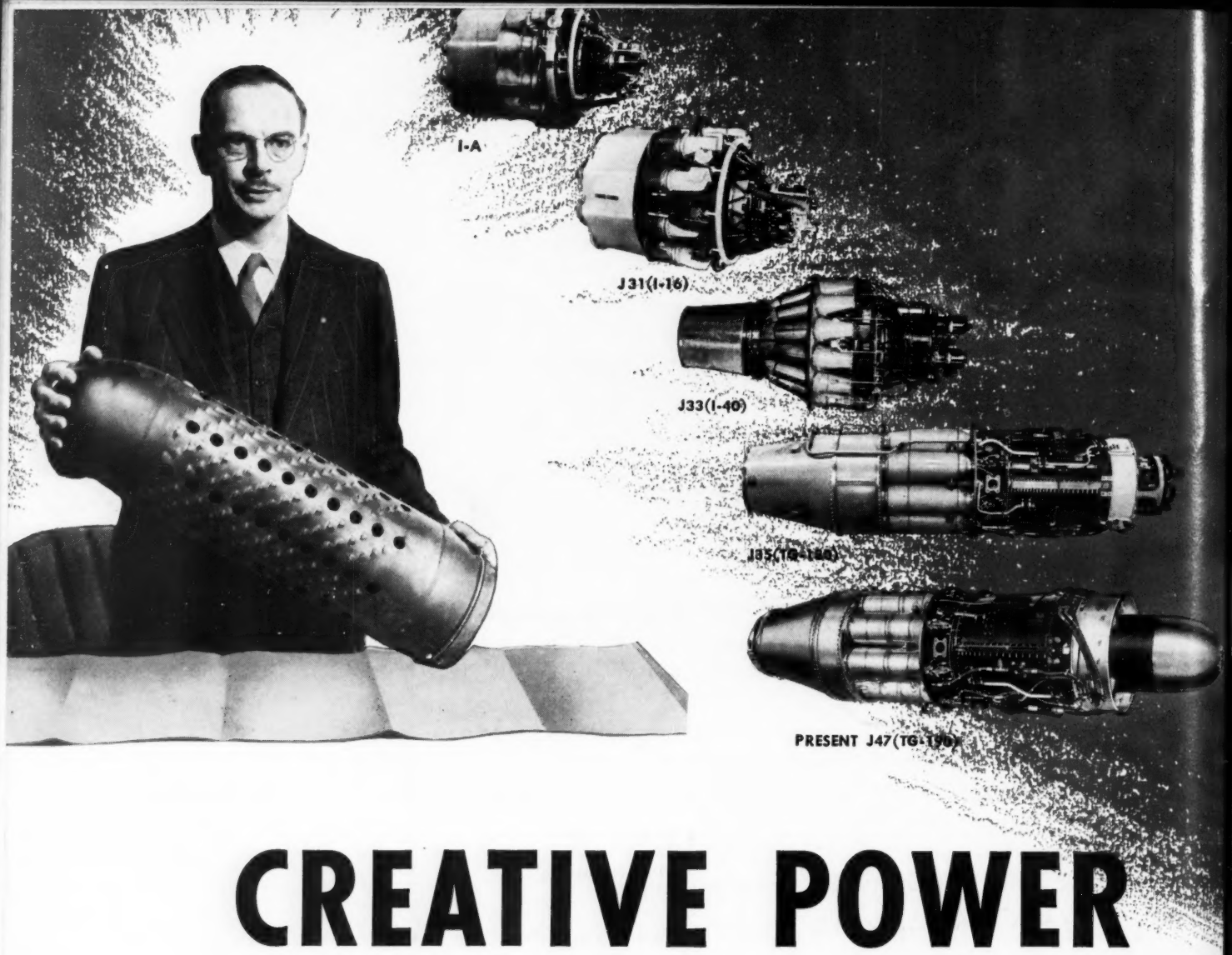

CREATIVE POWER

The creative power of D. F. "Truly" Warner, designing engineer with General Electric's Aircraft Gas Turbine Divisions, sparked the design or development of five great G-E jet engines. With an impressive design background in steam turbines and turbosuperchargers, Warner pioneered aircraft gas turbine development in this country. His first work was based on the original Whittle engine.

He designed the I-A and I-16 engines which powered Bell's P-59—the first jet-propelled plane in the United States. He supervised the design of the I-40 engine—power source for Lockheed's F-80 "Shooting Star." In 1945 he took over further development of the J35 engine originally designed in Schenectady. Shortly after, he supervised design and development of the J47, one of the most powerful jet engines in production. The J47 furnishes power for North American's F-86 and B-45A, Boeing's B-47, Republic's XF-91, and supplements G-E turbosupercharged piston engine power in Convair's B-36.

Many G-E engineers such as "Truly" Warner are working today to provide new and better products for you and the aviation industry. Your nearest G-E representative will describe in detail the aviation products we engineer and manufacture. See him today. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

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